Electrical World

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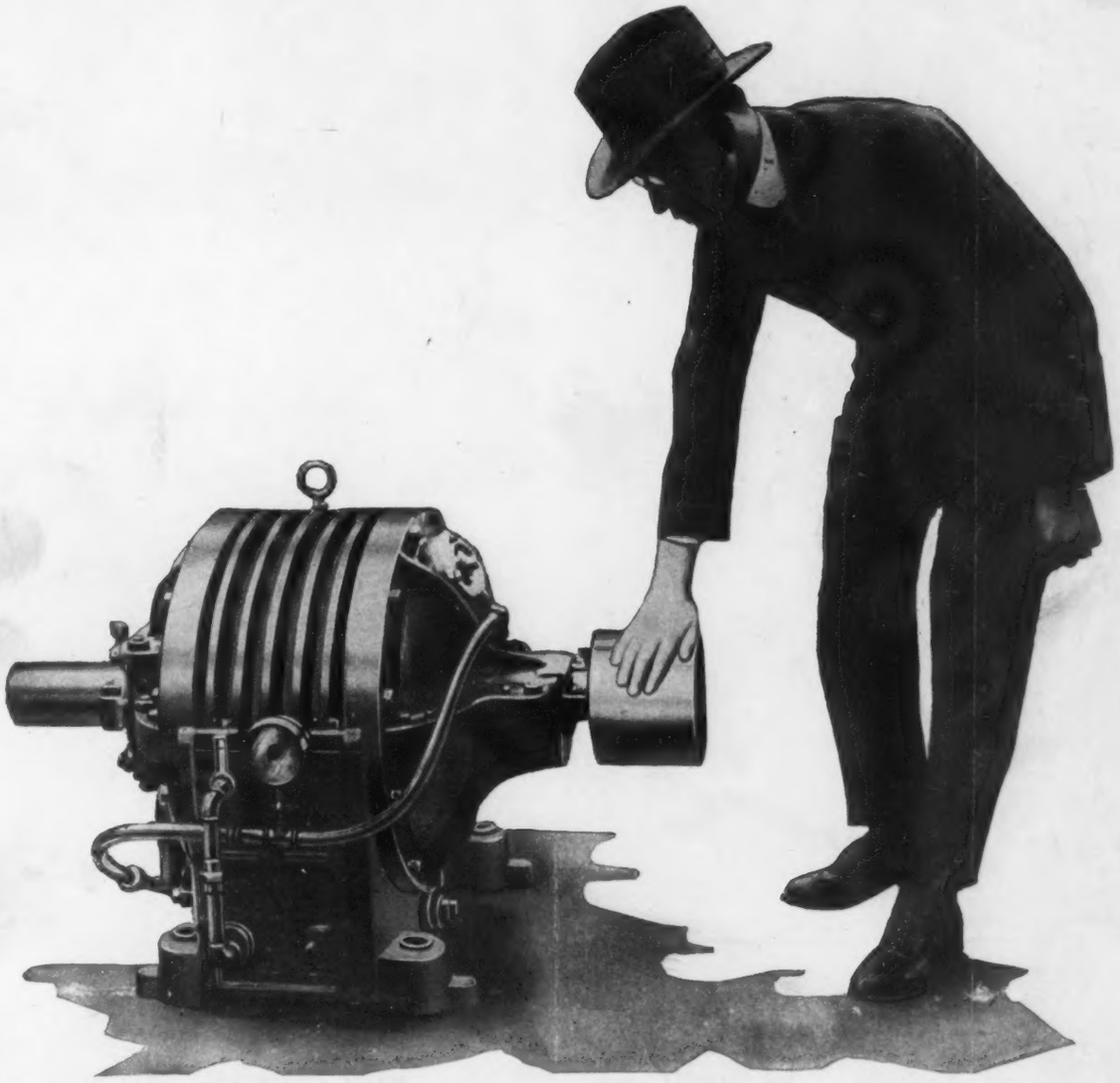

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Work for Willing Hands

THE Department of Labor is engaged in a campaign for encouraging building of all kinds in order to counteract the tendency toward industrial unrest because of non-employment. The idea is a good one and should be encouraged both by the government and by private individuals. We know of one way in which the government can help. The passage of the water-power bill will give work to hundreds of thousands of men erecting dams, power houses, etc., and will also give added impetus to the development of industries seeking cheap power. To cite a concrete case, the largest manufacturer of automobiles is anxious to erect a factory in a certain community and to develop a few thousand horsepower in a navigable stream. Aside from the work which the erection of the dam and the factory would start, the establishment of the factory in that particular locality would mean an increase in the population of 25,000 people. This in turn would involve the erection of dwellings to house these workers and would contribute to the general prosperity of the community. All of this work is contingent on the development of water power, however, and this must await the pleasure of Congress. Certainly one cannot believe that Congress would deliberately stand in the way of progress or the advancement of American industries, and yet that is what inaction on the water-power bill really amounts to. Is it asking too much for the government to practice what it preaches?

By lifting the censorship now prevailing on operating troubles in many utilities, engineering practice can be revitalized and an enormous amount of lost motion prevented in future developments. The frank discussion of equipment difficulties among engineers is needed at all times, and if personalities are kept out by an honest desire to learn the best ways of doing things electrically, a new era of technical progress will be entered.

The Responsibility of Commissions

WITH the public utilities commissions of the various states rests in a measure the responsibility of determining the speed with which new power-plant work will get under way. The necessity of doing the work is apparent to all, but there are two determining factors. These are, first, getting the capital with which to do the work and, second, getting the approval of the commission of the issuance of securities for the purpose. It is folly to say or to believe that the money is not available. It is available, but the price that must be paid for it is in excess of that which commissions are accustomed to concede as fair. That is about the present situation. Capital is demanding an increased wage, commissions are debating on the advisability of granting it, because it will for a long time be reflected in rates, and meanwhile the excellent labor that is returning from Europe on our transports is anxiously waiting for the much-talked-of construction work to open up. Nobody envies the commissions their position of responsibility in making the decision that will start this construction or retard it. It is only to be hoped that they will, after adequate deliberation but without unnecessary delay, take some action so that the people who are to furnish the money, the interested labor and those who require the power may all know what to expect.

The time has come to encourage traversing the branch lines of inviting research denied the investigator during the period of hostilities. It would be a calamity if many promising "leads" should be lost to mankind through the failure of erstwhile war industries to preserve adequate records of their investigations.

Government Initiative Lacking

THERE are three phases of the general subject of interconnection of electric generating systems now up for attention—(1) the present practice of electric companies in interconnecting contiguous generating systems, the advantages of which are so obvious as to require no comment; (2) the proposal of Secretary Lane to ascertain if it is practicable to apply the principle in a wider way so as to involve more power producers, and (3) the extreme suggestion of the Smithsonian Institution of the United States National Museum that transmission systems be made common carriers. The fundamental principle underlying the plan is sound. The proponents recognize that the electric circuit provides a most practical and economic means of transporting energy and of distributing it easily to consuming centers. From an engineering standpoint the plan presents no insuperable difficulties; in fact, it has become more of a financial than an engineering problem and as such will take care of itself. Hence the objection to governmental duplication of effort. The idea of interconnection of transmission systems emanated from within the electrical industry itself and represents an evolution in the art. Moreover, the industry is capable of applying the scheme wheresoever and whensoever conditions indicate that in-

terconnections should be made. But if the government must busy itself in power matters, let it take up original problems of greater national importance. Our coal supply, for instance, is limited and the whole nation is interested in its conservation. The government might, therefore, profitably turn its attention to the destructive distillation of coal, and if it displays the same degree of skill in the solution of this problem that the meat packers manifest in their particular field or the oil refiners in theirs, the art of producing gas, electricity, heat and refrigeration may be entirely revolutionized and the products cheapened to the advantage of the nation. Research of this kind is performed by the government for the farmer and ought to be extended to the industries of the country in general. The tendency of the government is to follow after and appropriate the work of others, whereas it would not be a bad idea for it to exercise some initiative itself.

Electric heating design commends itself to the engineer who feels that standardization has eliminated many of the opportunities of the art of illumination and power supply. Who can predict the size of the heating loads of a decade hence? The combinations of material required to yield efficient service under severe conditions of space, surroundings and time element challenge the ingenuity of the highest inventive talent.

War-Time Development of Vacuum Tubes

THE article by Capt. Ralph Bown appearing in this number is a very interesting description of that phase of the United States Army Signal Corps' work dealing with the development of the vacuum tube since America's entry into the world war.

At that epoch, when the Signal Corps took the matter up, the three-electrode vacuum tube, although standardized to some extent for the purposes of wire telephony, was a flimsy, delicate and uncertain device in radio communication, requiring careful adjustment and expert attention. In other words, it was a laboratory device rather than an army instrument. It has been said that an instrument really adapted to army service must be capable of being dropped from the back of an army mule, either into deep water or onto a hard road, without detriment to its serviceability and must work equally well in tropical sunshine or in pouring rain. Even allowing for exuberance of professional pride, it must be admitted that many of the engineering instruments which the army has adopted in the past meet these conditions in a surprisingly high degree.

After about a year of effort in the directions described by the article, and with the aid of the electrical engineering companies mentioned, the Signal Corps did wonders in transforming the delicate vacuum tube into a standardized army instrument; so that a vacuum-tube amplifier or oscillator could be manufactured, shipped and operated under war conditions in large numbers, and without much dependence upon highly specialized skill. It is common parlance to say "as like as two peas" when attempting to suggest a high degree of uniformity, but to the initiated the phrase "as like as two vacuum tubes manufactured for and accepted by the Signal Corps" would convey the idea of a degree of uniformity far higher than the humble and esculent pea could ever hope to attain.

Captain Bown's article is of great technical value at the present time because it records the stage in mechanical, electrical and manufacturing development which the Signal Corps was able to secure, in the brief time at its disposal, toward filling the requirements of military radio communication. In future vacuum tubes at least as good as those specified should become available for the industry in times of peace. A landmark is thus established for the electrical industry that will help the whole world for all time. It is no exaggeration to say that this landmark is probably as far ahead of the ante-war stage as twenty years of peace development could have hoped for. This does not mean that we should wait for a war to develop our implements of electrical communication. The cost of the gain in human life and commodities would be too overwhelming. It does mean, however, that against the colossal losses of the war, there may be set some countervailing achievements of the world, from the contemplation of which we may draw such solace and relief as the darkness of the entire picture may afford.

Captain Bown, in giving us this pen picture of what his corps was able to accomplish, unconsciously also throws credit upon his own share.

Let no reader of the journal fail to commit his experiences and impressions as to achievements and possibilities to paper where such information might be helpful now or later in the conquest of matter for the good of civilization.

Safe and Sound

IT CONCERNS each one of us to see that every part of the electrical industry is squarely on its feet, to make it realize that it has come safely through one of the greatest crises in history, to give it confidence that everything is not going to the "demnition bowwows." We are not very strong for the proposition of denying the truth about business conditions. We believe in facing the facts, but, once having accepted them, we have sublime faith in the virtue of developing the constructive features. The small boy who thought that by digging a hole in his back yard he would make it possible for a Chinaman to pop up his head in this country had a more productive imagination than his playmate who could see nothing but the disarranged yard. We are not for digging a tunnel to help Chinamen get into the country, but we have sympathy with the idea of working for what we do want rather than sighing over what we don't want.

The electrical industry, like the rest of the country, looks back on a record that is full of accomplished deeds. Every department of the industry has good reason to be thankful. Most of the people are alive; most of them are uncrippled; most of the companies have a splendid total of gross business on the books of the last four years which left some profit behind as it was turned out. The decks are being swept clean for another try. While the President is fixing up the League of Nations, Congress is floundering to be sure, but when we look around it doesn't take a telescope to see that

big policies are in the process of making. Copper and steel are sliding off in price, and until they are where they ought to be from an economic standpoint they will be more or less unsteady. Labor is not any too happy, and we all hope that there will be a fair adjustment of its relations to capital. Neither one of these foes who ought to be friends and partners will get too much. Capital will still have to foot big tax bills and labor be more efficient in order to make its job yield the necessary flow of weekly dollars.

It is certainly a time to try the mettle of the industry, but the mettle is sound. With it all we believe that there is a strong disposition to get the utmost benefit out of conditions. The manufacturers understand the situation thoroughly and are prepared to do what they can to align themselves with the tendencies of the times. Central stations in several instances have already sold large blocks of securities and are catching up with their facilities and getting ready for the demand that is inevitably ahead of us. More companies will do what the few have done. Uncle Sam will not always ask all the investment funds; the way will be open sooner or later for easier borrowing. Let all who have sound capital and earning position get ready for it. If everybody in the electrical industry should decide at the same moment that the time to do business had come, there would be plenty of work for idle hands.

We shall get in time a domestic business that will put all other totals into dim insignificance. There will be a foreign trade in electrical apparatus and supplies which will put United States products into large world markets. The day may arrive when we shall look back upon the words of L. K. Comstock (printed in the ELECTRICAL WORLD of Feb. 8, 1919) with regret if we did not forge ahead in the spirit they expressed: "The electrical industry, American business, must grapple with the problem and move forward with a bold stride. It must not turn back and yearn for pre-war prices, but confidently forge ahead with the conviction that success will attend its efforts. . . . There are fifty persons who can figure out sure failure to one who pushes on without thinking of the possibility of failure."

Only a fraction of what the electrical industry did to help win the war has as yet been made public. Let every engineering school curriculum include lectures by industrial and technical experts giving concrete examples of how the armies and tools of production were mobilized and concentrated to meet the call of the men at the front.

Good Lighting and Efficiency

THE advantage of good lighting in industrial operations is now a commonplace. Every factory manager recognizes the broad significance of the facts, but, ground between the unions and the board of directors, he is too apt even now to look askance at the additional costs. Although assured that improved lighting means more and better product with all that that implies, he still may remain uncertain as to whether the improvement is worth the money it costs to install and maintain. Such, indeed, has been the difficulty in introducing improvements of any kind tending to better or increase the output. In the case of simple machinery the problem is easily solved, but lighting partakes of the nature of improvement in general efficiency, of which the immediate results cannot be accurately foreseen. Professor Clewell's article in the current issue will tend to clear up some of the difficulties which exist in this particular.

Perhaps the simplest basis for dealing with the benefits of good illumination is that suggested by Professor Scott of looking at the cost of lighting in terms of workmen's wages for a given period. If a thousand workmen by good lighting of the shop can save five minutes a day of active work, the total gain amounts to five thousand man-minutes per day, and if the average wage be reckoned as a cent a minute, not far from a machine-shop figure, expenditure for good lighting would yield a profit to the management at anything less than the total expense of fifty dollars a day, a sum which would pay for a great deal of thoroughly efficient lighting. Aside from this, there are gains not only in the saving of time, but in better workmanship, reduced accidents, and better shop conditions generally, which result in decreased friction with the employees. There has been, however, a lack of sufficient data on which to base judgment of even this simple consideration. Therefore tests like those conducted recently by the Commonwealth Edison Company are of high importance as furnishing for the first time something like quantitative data as to the results of good lighting, thus confirming what one may call the clinical data due to general observation.

These facts are of special importance in relation to the question of night shifts, although in every shop they are of much moment during part of the year. With the general coming of the eight-hour day the double shift assumes unwonted importance to a large number of men who on a universal eight-hour basis might join the throng of the jobless. Even were this expedient not adopted and an industrial change working toward more uniform activity throughout the year should come about, good lighting will still remain an important factor in production. One of the serious industrial questions in this country is a tendency toward seasonal working in many occupations, brought about by comparatively recent selling methods. This may make gains at one point in the capital charges, but loses in lowering the utilization factor of the plant and in compelling an increase in the wage scale.

Another interesting matter touched upon by Professor Clewell deals directly with the double-shift question in raising the question of the relative cost of double shifts with proper artificial light in existing plants as against the increase in plant needed if the output is to be secured on a single eight-hour shift. He shows that the cost of thoroughly good artificial lighting for night work is likely to be very much less than the space rental, to say nothing of the overhead, involved in increasing the plant to a point at which its output can be secured on a single shift. With the present tendency toward intensive working of every kind, the arguments in favor of the use of first-class artificial lighting are greatly strengthened, and we believe that further investigation along the lines pursued by the Commonwealth Edison Company will make an incontrovertible case for great improvements in workshop and factory illumination.

Transmission-Line Computations

Use of Hyperbolic Functions Favored in Comparison with Alternative Methods for the Calculation of Voltage, Current and Power on Long Uniform Transmission Lines

BY A. E. KENNELLY
Professor of Electrical Engineering, Harvard, and Director of Electrical Research, Massachusetts Institute of Technology

IT IS well known that long alternating-current lines of the ordinary three-phase system, operated under a known steady load at the motor end and under a known impressed emf. at the generator end, develop distributions of voltage, current and power which can only be computed to a first approximation if all of the capacitance distributed along the line is assumed to be applied in one lump at the middle of its length. In other words, a strict computation of the electric behavior of the line must take the uniform distribution of capacitance into account. If the total line capacitance, instead of being taken as applied as a single lump in the middle of the line, is divided into halves and each half is applied at one end of the line, we obtain what is sometimes called the "split-condenser" diagram and method of computation[1]. In this method the error of computation is less than when all of the capacitance is applied in one lump. For many practical purposes it suffices to use the split-condenser method, especially with transmission lines not exceeding 200 km. in length, at frequencies not exceeding 60 cycles. If, however, precision is aimed at, and especially in cases of long lines operated at high frequencies, the error of lumped capacitance cannot be ignored, and a more nearly accurate method of computation must be adopted.

Various methods for computing the voltage and current at any point of a long uniform alternating-current line have been proposed[2] by Heaviside, Leblanc, Thomas, Franklin and others. In the opinion of the writer, however, the use of hyperbolic functions[3] is by far the shortest and simplest method. In two articles appearing in the ELECTRICAL WORLD early in 1918 T. A. Wilkinson[4] presented modifications of the hyperbolic-function method and formulas and worked out some interesting graphic charts in connection with them.

It is no doubt advantageous for electrical engineers to have in their possession alternative methods of attacking their problems, and there is no intention of criticising the Wilkinson methods adversely. However, it is proposed here to show, by means of the example offered and worked out in the Wilkinson article, that the direct hyperbolic method is, in the writer's opinion, at least as short as any that has yet been proposed for such general problems. It is contended that it is better to follow the fundamental method in all such cases, rather than change to a special method within a restricted field.

One wire of the three-phase system considered in Mr. Wilkinson's problem is represented in Fig. 1, with one-third of the total three-phase load applied to it. Since the voltage between wires at the receiving end is supposed to be 110,000 volts r.m.s., the star voltage to neutral at the receiving end b is $110{,}000/\sqrt{3} = 63{,}508$ volts, leading the received current of 110.498 amp. r.m.s. by 18° 11′ 41.5″ in phase. The impedance of the branch load is therefore $\sigma = 574.75 \angle 18° 11' 41.5''$ ohms, or $546.01 + j179.467$ ohms.

The angle θ subtended by the line wire ab, at 60 cycles, is $0.52521 \angle 83° 26' 27''$ hyperbolic radians, or $0.059994 + j0.52177$, as shown in equations (1) and (2). The real part of this angle is expressible in hyperbolic radians, and the imaginary or j part in circular radians. If the imaginary part be expressed in quadrants instead of in radians, $\theta = 0.059994 + j0.33217$ hyp. as given in (3). This quadrantal form of the imaginary is useful in using the charts that have been worked out for such computations.

The surge impedance z_o of the line wire is likewise expressed as $396.383 \angle -6° 33' 33''$ ohms, as shown in (4).

The position angle δ_b, at the receiving end b of the line, is such that its tangent is equal to $\sigma/z_o = 1.450 \angle 24° 45' 14.5''$. By reference to a chart atlas[5] of hyperbolic tangents this angle $\delta_b = 0.6260 + j0.73465$ hyps. As a matter of fact, the charts published do not admit of graphical interpolation to four or five significant digits; only two or three significant digits can be determined. However, the published tables[6] permit of interpolation to four or five digits, when it is worth while taking the time necessary for effecting such interpolation. In order to arrive at a precise solution in this case, the numerical work has been carried to four or five digits, whereas in practice three would probably be sufficient.

The position angle δ_a at the generating end a is then found by adding θ to δ_b, as in (6).

The general law of currents along a line is that at any point the current is proportional to the cosine of the position angle, while the potential is proportional to its sine. Knowing E_b, the star potential at b to the neutral, the star potential E_a is found by direct proportion, as in (7) and (8), to be $69{,}569 \angle 35° 35' 47.5''$ r.m.s. volts. Two references to the charts or tables are needed for this step; namely, one for each sine.

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[1] "Calculation of the High-Tension Line," by P. B. Thomas, *Transactions A. I. E. E.*, June, 1909, Part I, Vol. 28, pp. 641-686.

[2] O. Heaviside, "Reprinted Electrical Papers," London, 1892, Vol. 2, p. 247. M. Leblanc, "Formula for Calculating the Electromotive Force at Any Point of a Transmission Line for Alternating Current," *Transactions A. I. E. E.*, Vol. 19, pp. 759-768, June, 1901. P. H. Thomas, "Calculation of the High-Tension Line," *loc. cit.*, 1909. W. S. Franklin, "Electric Waves," pp. 144-153 (Macmillan, 1909).

[3] A. E. Kennelly, "The Application of Hyperbolic Functions to Electrical Engineering Problems," 1911, Chapter VII; also "Artificial Electric Lines," 1917, Tables VIII and IX.

[4] T. A. Wilkinson, "Graphical Determination of Line Constants," ELECTRICAL WORLD, Feb. 2, 1918, p. 244, Vol. 71, and also March 16, 1918, p. 558, No. 11, Vol. 71, p. 558.

[5] "Chart Atlas of Hyperbolic Functions," Harvard University Press, 1914.

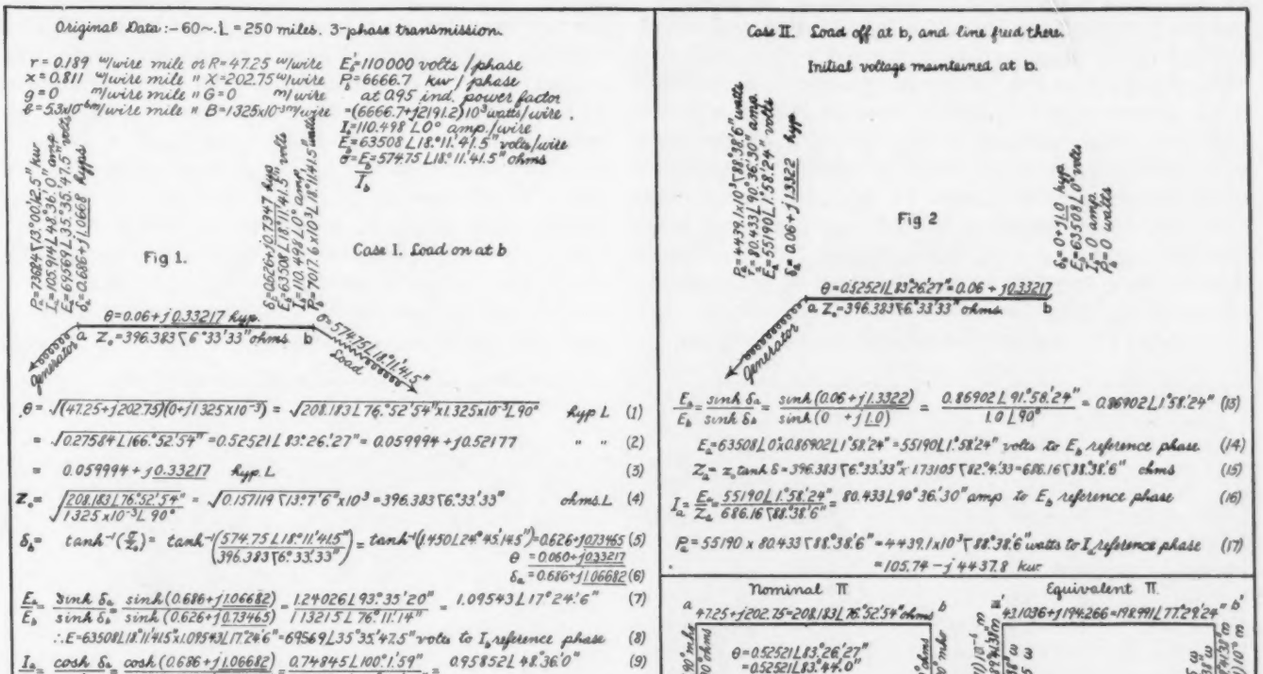
[6] "Tables of Complex Hyperbolic and Circular Functions," Harvard University Press, 1914.

Similarly, the current I_a entering the line at a is found by direct proportion from the known current I_b at b, through (9) and (10), to be $105.914 \angle 48° 36'$ r.m.s. amp. Two references to the charts are needed for this step: namely, one for each cosine.

Finally, the power at a is found immediately, from the voltage and current thereat, to be $7368.4 \angle -13° 0' 12.5''$ kw., or 7179.4 active kilowatts and 1658 condensively reactive kilowatts.

The complete solution of vol' ge, current and power is thus effected with the aid of five references in all to hyperbolic charts or tables.

In Fig. 2 the line is indicated as having the load thrown off at b, but the same voltage maintained there as before. The voltage, current and power at a are


Original Data:- 60~. L = 250 miles. 3-phase transmission.
r = 0.189 ω/wire mile or R = 47.25 ω/wire
x = 0.811 ω/wire mile " X = 202.75 ω/wire
g = 0 mho/wire mile " G = 0 mho/wire
c = 5.3x10⁻⁶ mho/wire mile " B = 1.325x10⁻³ mho/wire
E_b = 110000 volts / phase
P_b = 6666.7 kw / phase
at 0.95 ind. power factor
= (6666.7 + j2191.2)10³ watts / wire.
Fig 1.
Case 1. Load on at b
Fig 2
Case II. Load off at b, and line fed there.
Initial voltage maintained at b.
θ = 0.06 + j 0.33217 hyp.
Z_a = 396.383 ⌜6° 33' 33" ohms
Generator
Load
Fig 3.
Nominal π
Fig 4.
Equivalent π

COMPUTATIONS MADE TO COMPARE RELATIVE EASE OF USING HYPERBOLIC FUNCTIONS AND SIMPLIFIED MODIFICATIONS OF THEM. (SEE T. A. WILKINSON'S ARTICLE, "ELECTRICAL WORLD," MARCH 16, 1918, PAGE 558

then determined in (14), (16) and (17), with the aid of three references in all to charts or tables. The current I_a at a falls off from 105.914 amp. in Fig. 1 to 80.433 amp. in Fig. 2. The active power P_a in Fig. 2 falls off to 105.74 kw.

Finally, in Figs. 3 and 4, an alternative method of solving the problem is presented through the use of the "equivalent π" of the line wire. In Fig. 3 is the nominal π, which corresponds to the split-condenser diagram already referred to. The line ab has the full conductor impedance $47.25 + j202.75$ ohms of the actual line, and each of the two terminal leaks has $j0.6625$ millimho. Knowing the angle θ subtended by the line, for the frequency of 60 cycles, as in (1) and (2), we find from tables or charts the correcting factor $(\sinh \theta)/\theta = 0.95584 \angle 0° 36' 30''$. This applied to the line impedance ab gives $198.991 \angle 77° 29' 24''$ ohms, then follows by Ohm's law. The equivalent π thus uses the split-condenser method, but eliminates the errors due to its two terminal lumped capacitances.

The computation of the equivalent π is evidently brief and direct, but the subsequent computation of the voltage and current drops over it by Ohm's law takes longer. The method of position angles contained in (1) to (2) is therefore, as a rule, shorter and swifter than the method of the equivalent π. They offer mutual numerical checks, however, when great precision is aimed at.

For practical purposes, and to ordinary slide-rule precision, the published charts enable any similar problem to be worked out in a few minutes' time. When, however, five-digit accuracy is sought, interpolation has to be resorted to in the use of the tables, and this takes considerable time.

War-Time Development of Vacuum Tubes

Most Important Advance in Radio Engineering—Three Stages—Determining Desirable Characteristics—Designing Tubes Having These Requirements and Capable of Being Produced in Quantities—Specifications and Test Methods

BY RALPH BOWN
Captain Signal Corps, United States Army

THE first important technical problem which the Signal Corps of the United States Army faced in expanding its radio development work at the entrance of this country into the war was that of obtaining suitable vacuum tubes.* It was apparent that these tubes would be a necessary and vital component of practically every piece of equipment to be developed, and that there must be available perfected and standardized tubes in quantities far greater than had ever before been attempted. The success with which this need has been met may be judged from the fact that within less than six months after the initiation of the work such standardized tubes were in production and that at the cessation of hostilities in Europe the production rate was in excess of 1,000,000 per year and large reserve stocks had been accumulated. The object of this article is to recite briefly the story of this remarkable war-time development.

In July, 1917, when the Signal Corps took up its war-time radio development work, the vacuum tube was probably represented in the mind of the average engineer by the "audion" detector, which had been on sale for several years in a variety of forms and had been rather widely employed, particularly by amateur radio enthusiasts. The tubes thus marketed were too unstable, critical and non-uniform for military use and required careful handling and expert adjustments of the filament and plate voltages for their successful operation. A common form of the audion detector is illustrated in Fig. 1a. Certain high-vacuum tubes had been constructed on a laboratory basis by the Western Electric and General Electric companies which were more stable and of wider application than the audions, and the American Telephone & Telegraph Company was using in comparatively small quantities a telephone repeater vacuum tube which had been partly standardized. In Europe the French had developed and were making and using in considerable quantities a tube which was fairly uniform and of fairly good performance. There were, however, no tubes in existence which had the properties which would insure the successful operation of future radio apparatus needed in military service and which would eliminate complications which are so undesirable in military equipment. In the United States the basic principles of vacuum-tube design were undoubtedly better understood than in any other country, but this information was confined almost entirely to the engineering staffs of the Western Electric Company, the General Electric Company and the DeForest Radio Telephone & Telegraph Company. The Western

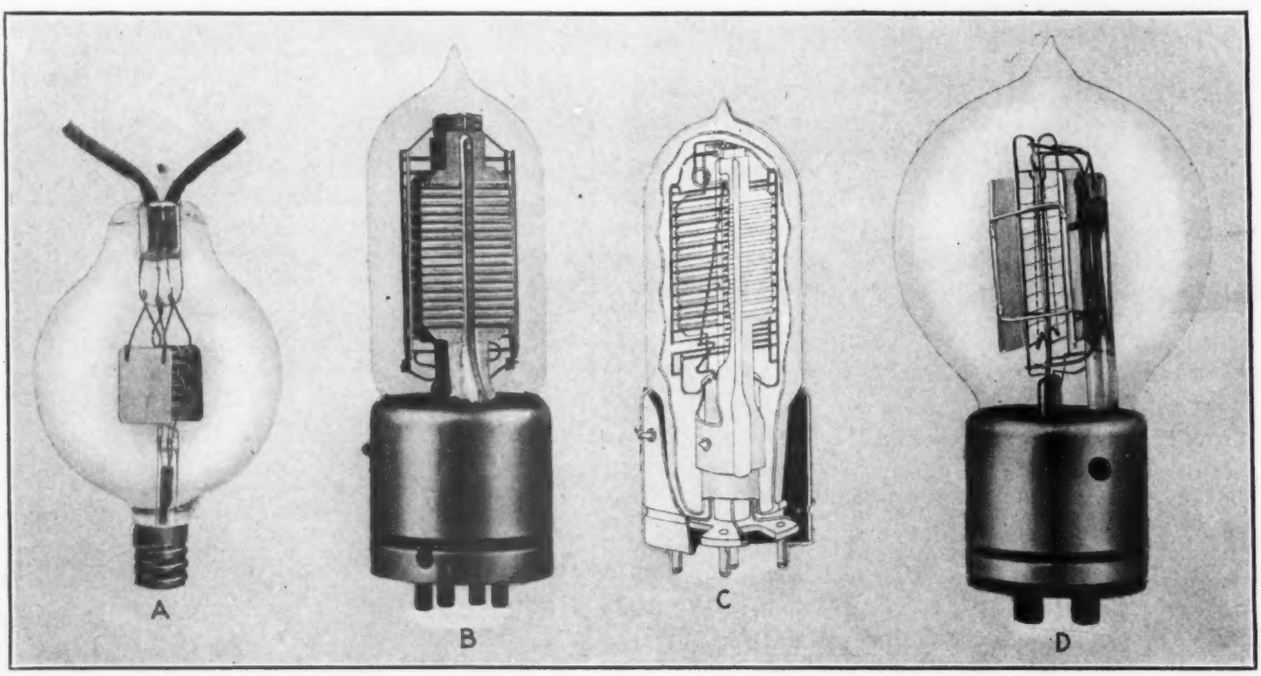


FIG. 1A—PRE-WAR AUDION DETECTOR; B—SIGNAL CORPS TYPE VT-1 VACUUM-TUBE DETECTOR AND AMPLIFIER; C—PHANTOM VIEW DRAWING OF TYPE VT-1, SHOWING STRUCTURAL DETAILS; D—SIGNAL CORPS TYPE VT-2 VACUUM TUBE FOR PRODUCTION AND MODULATION OF RADIO-FREQUENCY POWER

*The term "vacuum tube," while possibly unfamiliar to some engineers, has come to be generally accepted as a collective designation covering the various types of the three-electrode thermionic device which had its origin in the "audion" invented by Dr. Lee De Forest.

Electric Company in particular had accumulated a valuable fund of knowledge and experience from its development of the vacuum-tube telephone repeater. The Signal Corps, therefore, at once enlisted the services of these companies and worked in close coöperation with them, directing their efforts along the necessary lines.

From the Signal Corps' standpoint the undertaking resolved itself into three parts or stages. It was first necessary to decide what kinds of tubes were needed and exactly what characteristics they must possess. Secondly, satisfactory sample tubes must be designed which would possess the required characteristics and would be capable of being duplicated in large quantities. The third and most novel problem was to write exact specifications and develop testing methods for an inspection which would insure that the product passing the inspection was in every way up to the required standard and maintained the necessary uniformity. For a device which has as many aspects and governing characteristics as a vacuum tube this is no small task to be accomplished in the short space of a few months. The first and third portions of the undertaking were brought to successful solution by Signal Corps engineers, while the second portion was solved by the commercial companies who were in coöperation with the Signal Corps on the work. The three stages of the problem will be discussed in numerical order.

Vacuum Tube Requirements.—It was at once decided to develop two types of tube, one suited to receiving functions and one suited to transmitting functions. These were to be so balanced in their adaptabilities that they would serve successfully, either separately or in combination, for any uses contemplated. All apparatus was to be designed to employ one or both of the standard types according to its needs. These requirements necessitated that the receiving tube be suited to operation as a detector of damped oscillations, as an oscillating detector of continuous oscillations by the heterodyne method, and as an amplifier of audio and radio-frequency alternating currents. On the other hand, the power tube must be an efficient oscillator for the production of radio-frequency alternating-current power and have the proper characteristics to serve as a modulator of such power for radiotelephony. Furthermore, the adjustments necessary to the operation of both types must be reduced to the absolute minimum.

Specifically, the tubes must show uniform operation over ranges of 20 per cent variation of filament and plate voltages since no rheostats or potentiometers were to be allowed and the tubes must automatically adjust themselves over the range of voltage (initial to discharge) impressed by the fixed storage batteries and dry batteries or dynamotors used in the circuits. This requirement was a radical departure from practice with ordinary vacuum tubes, which depended for proper operation upon careful adjustments of filament and plate voltages. It required a combination of inherent stability, uniformity and flexibility previously unknown in radio practice. All tubes were to possess a high degree of electrical and mechanical ruggedness and a reasonably long useful life over which they would maintain their initial characteristics without appreciable change. They must be pumped to have and retain a high vacuum so as to be free of any appreciable effects due to ionization of residual gas.

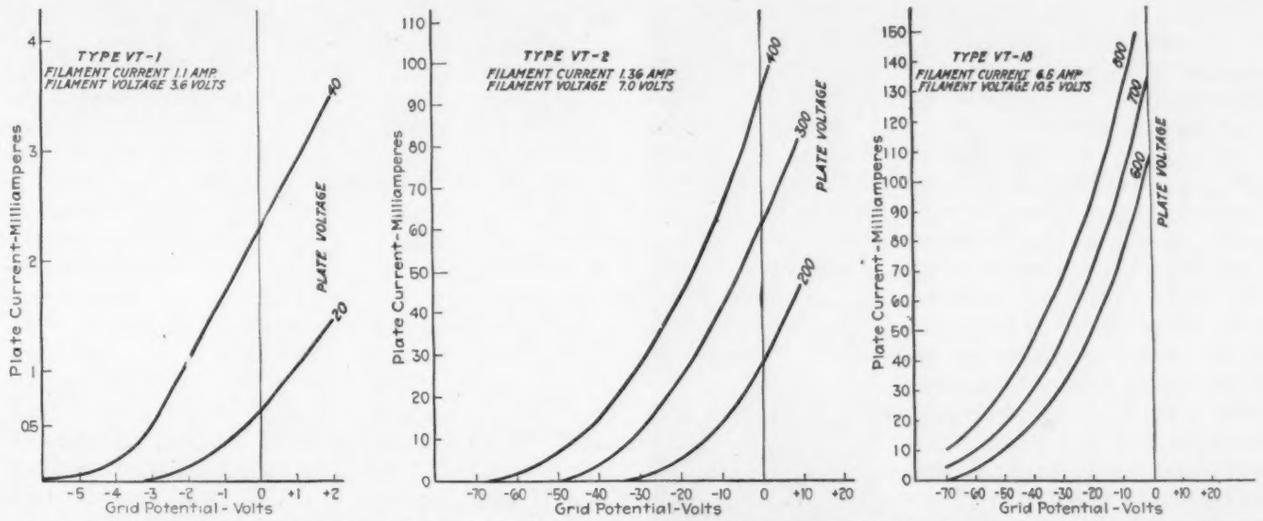


FIG. 2—CHARACTERISTIC CURVES OF THE TYPE VT-1; FIG. 3—CHARACTERISTIC CURVES OF THE TYPE VT-2; FIG. 4—CHARACTERISTIC CURVES OF THE TYPE VT-18

The ideal condition desired was that it should be practical to replace any tube operating in any set by any other tube of the same type without affecting the operation or requiring any readjustment of the set. The completeness with which this ideal condition was finally realized is most gratifying. For example, the first type of Signal Corps amplifier built, and the one used most successfully and in the largest quantities, is entirely devoid of adjustments of any kind. It is merely a box containing the necessary transformers, wiring, dry battery units and vacuum tubes, and is provided on the outside with two binding posts for direct connection to a 4-volt storage battery, with two binding posts for the input current to be amplified, and with a jack for the insertion of the plug of the standard telephone headset. There are no knobs, switches or rheostats whatever. When connected up it amplifies and continues to do so until the batteries are exhausted. Greater simplicity could hardly be attained. With

power tubes the conditions are somewhat more severe, and in some cases a filament rheostat has been used. However, this is only to compensate for gradual battery voltage drop due to discharge and the frequency of its adjustment is measured in hours.

Tube Development.—Actual tube-development work, which was started in August, 1917, proceeded rapidly through the remaining months of the year, and various sample tubes of both tungsten and coated-filament types were carefully examined, tested and compared in every way. The receiving tube which was finally adopted as most suitable for Signal Corps use is the type VT-1, illustrated in Figs. 1b and 1c. This coated-filament tube, developed and manufactured by the Western Electric Company, has well-balanced electrical characteristics and high electrical efficiency along the required lines, and it combines therewith such a remarkable degree of mechanical ruggedness as to have been commonly known as the "battleship type."

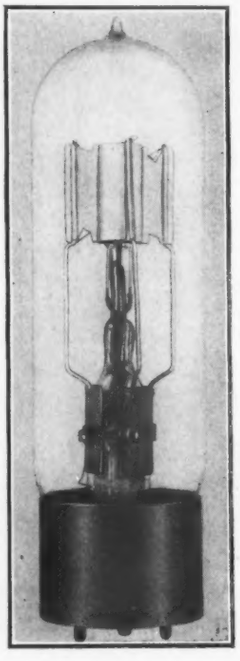


FIG. 5—SIGNAL CORPS TYPE VT-18 VACUUM TUBE

As shown in Figs. 1b and 1c, the corrugated plates, punched from sheet steel, form a cylinder at the bottom which fits tightly around the glass stem. At the top they join again and are clamped about a small square plinth of special insulating material. The grid, also punched from sheet steel, is supported at the bottom by the lead-in wires and at the top by bracing wires embedded in the plinth of insulating material. The V-shaped filament of twisted platinum strip coated with thermionically active compounds is held taut by an insulated spring support at the top. Thus the whole structure is rigidly tied together and clamped tightly to the stem, giving the strength and perfection of alignment which are essential to permanence and uniformity. The base consists of a metal shell with a phenol-fiber diaphragm at the bottom which carries the connecting studs. In assembly the base is fitted over the bottom of the tube, the leads are soldered to the contact studs, and the whole is inverted and poured full of insulating wax. The ends of the contact studs are capped with a non-corroding alloy, as are also the faces of the connecting springs in the sockets. This insures dependable contact under all climatic conditions.

The normal filament current of this tube is 1.1 amp. The filament circuit requires a 4-volt storage battery while the plate circuit operates from a fifteen-cell dry battery unit. When provided with the proper input transformer the average tube will give a power amplification of 200. This means that a two-stage amplifier composed of two of the tubes in cascade will give out 40,000 times the alternating-current power which is fed to its input terminals. The average life of the tubes is in excess of 500 hours. The ordinary characteristic curves of the VT-1 are given in Fig. 2.

It would be interesting to make a detailed mechanical and electrical comparison between the VT-1 and such previous designs as are typified by the tube illustrated in Fig. 1a. Unfortunately this would involve a more extended discussion than is allowable here. The reader can make a mechanical comparison from the pictures and statements already presented and an electrical comparison from the information given in these paragraphs and in previous literature.† Several excellent tubes of the tungsten-filament type were developed to the same specifications and standards as the VT-1, but none of these combined the necessary features to the degree of perfection attained by it. Some of them excelled in certain respects but were deficient in other important respects.

The development of power tubes proceeded somewhat more slowly than that of receiving tubes, and the difficulties of obtaining efficient design, mechanical strength and freedom from gas ionization and other electrical troubles were greater. The tube finally adopted for general Signal Corps use was a coated-filament tube developed and manufactured by the Western Electric Company. This tube, known as type VT-2, is illustrated in Fig. 1d, and its characteristic curves are given in Fig. 3. The normal filament supply is 1.36 amp. at 7 volts. The plate voltage is normally between 250 volts and 350 volts. The nominal high-frequency power output is 3 watts, but over 5 watts may be obtained without exceeding the safe limits of operation. The characteristics of the tube are such as to make it an excellent oscillator and modulator. While its output-input ratio as an amplifier is not much greater than that of the VT-1, it is capable of handling considerably more power, and it has thus been used where a more powerful amplifier than the VT-1 was needed. One or two types of tungsten filament tubes were developed along with the VT-2, but although they possessed desirable characteristics, such as greater freedom from gas and similar electrical troubles, they were not able to attain the same standard of performance and efficiency. In a tube of this size, hampered by considerations of efficiency and particularly by the use of a plate voltage of only 300, the tungsten filament is at a disadvantage and a successfully balanced design is difficult on account of the inherent physical properties of the material.

Although the types VT-1 and VT-2 have been adopted by the Signal Corps as standardized units for immediate use and the design and production of large quantities of equipment have been carried out on this basis, these tubes are by no means looked upon as the final solution of the problem of obtaining the best possible vacuum tubes for military use. Other very promising lines of development are under way.

Two main improvements are required in the receiving tube—a considerable decrease in the power necessary to heat the filament so that the storage-battery equipment and battery charging can be greatly reduced, and a decrease in the electrostatic capacity of the tube which will improve its operation as a radio-frequency amplifier, particularly for short waves. The VT-3 tube which has been developed and manufactured on an experimental basis by the Western Electric Company has these two improvements in view. It is particularly

†"Internal Relations in Audion-Type Radio Receivers," by Ralph Bown, *Physical Review*, September, 1917, Vol. X, No. 3.

successful as regards the first one since its filament requires only 0.2 amp. at 2 volts. The filament power input is thus less than 0.5 watt as compared with 4 watts for the VT-1.

The possibilities of the tungsten-filament tube when designed to use the larger filament input and higher plate voltage to which it is inherently better suited are illustrated by the VT-18 tube (Fig. 5) developed by the General Electric Company. It requires a filament

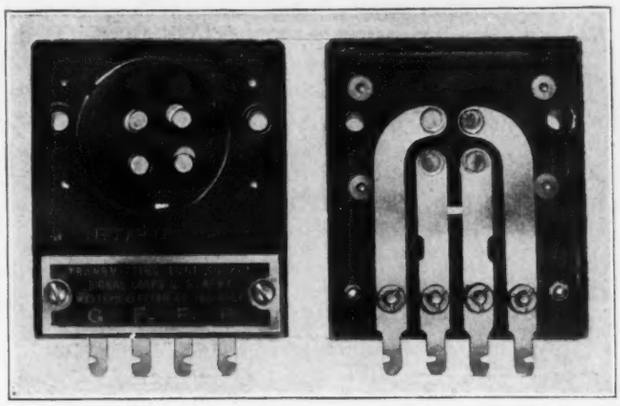


FIG. 6—TOP AND BOTTOM VIEWS OF SIGNAL CORPS STANDARD VACUUM TUBE SOCKET

current of 6.5 amp. at 10 volts and operates at a plate potential of 700 volts to 800 volts. It is capable of giving an output of 30 watts high-frequency power, and its characteristics are such as to make it well suited to use as a modulator. Its characteristic curves are given in Fig. 4. The tube is considerably more powerful than is required for the average equipment used in the past emergency, but for certain higher power equipment this sort of tube gives more satisfactory results than the combination of several low-power tubes in parallel.

The "type P" "Pliotron" made by the General Electric Company is a vacuum tube capable of producing 100 watts of high-frequency power. It takes a filament current of 3.5 amp. at 25 volts; approximately 0.2 amp. at 1500 volts is required by the plate. The tube is rather expensive and as now constructed is fragile. Nevertheless, from the electrical standpoint it is a fairly reliable piece of apparatus, and a limited use has been made of it by the Signal Corps. Tubes have been constructed similar in form to the type P which can successfully deliver a quarter kilowatt of high-frequency power. Such tubes usually require 2000 volts or 3000 volts potential on the plate electrode.

Standardization and Testing.—As a necessary preliminary to the standardization of the tubes themselves a standard design of base and socket was made. The four-contact bayonet type was selected as a basis of the design. The bases for receiving and transmitting tubes were made identical except for the angular position of the locking pin. In the bottom of each socket was placed an insulating shield pierced by four holes which allowed the base contact studs to project through and touch the contact springs beneath. The combination of this shield and the angularly displaced locking pins precluded the possibility of a tube being placed in the socket improperly or in the wrong socket and thereby eliminated a common source of annoyance and trouble. Fig. 6 shows one of the standard sockets.

The subject of specifications and the proper methods of testing receiving tubes had received careful study by the Signal Corps engineers during the progress of tube development, and with the beginning of quantity manufacture it became necessary to make definite and immediate application of these studies to the process of inspection. Therefore several rough sets of testing equipment were built in the laboratory, and officers were trained in their use. The sets were then installed by these officers at the various factories and inspection was started. The principles and methods applied in specifying and testing the tubes proved to be so satisfactory and effective that only a few very minor changes were found necessary in practice. After some weeks of actual trial had definitely settled the matter, several final testing sets were made up and installed to replace the rough laboratory sets. These new sets, together with the operating instructions and tube specifications, were turned over from the development to the inspection organization of the Signal Corps and have been operating successfully in its hands ever since. Aside from measuring instruments and storage batteries, a testing set consists of three parts—the amplifier test set, the detector test set and the oscillator test set (Figs. 7, 8 and 9).

In the amplifier test set the tube to be tested amplifies an 800-cycle alternating current. A double-throw switch allows cutting the telephone headset into either the input or the output side of the tube. The output side is provided with a variable shunt of the constant impedance type. The shunt is adjusted until the shunted output gives a signal of the same loudness as the direct input. The reading of the shunt is then a measure of the power amplification given by the tube. In order to pass inspection a tube must give more than a certain ratio of power output to power input. For the VT-1 tubes this ratio is 121. In the detector test set the tube is compared as a detector of modulated radio-frequency oscillations with a calibrated standard tube and must show equivalent or better signal response. In the oscillator test set the tube is connected to a standard circuit in which it must cause continuous oscillations if it is to be passed as a satisfactory oscil-

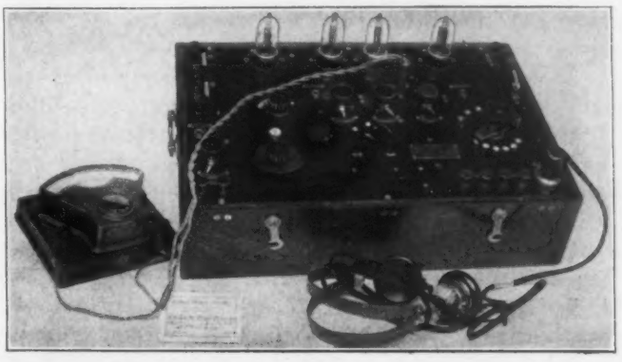


FIG. 7—STANDARD DETECTOR TEST SET FOR RECEIVING TUBES

lator. The tests are carried out at two filament and plate voltages corresponding respectively to the upper and lower variation limits of these factors under service conditions.

The sets are conveniently arranged so that other necessary measurements can be made in connection with

those mentioned. The resistance of the filament circuit is measured and must fall within certain specified limits so that the tubes will operate properly in series or in parallel without losing their interchangeability. The plate current is measured and is held to a certain maximum limit so as to reduce the drain on the small dry battery which in service supplies the current. A measurement of grid current is made under conditions

FIG. 8—STANDARD AMPLIFIER TEST SET FOR RECEIVING TUBES

such that it is indicative of the amount of gas in the tube, which must be within a limiting value. A determination of the insulation resistance between the various electrodes is made and the limit of this resistance is specified.

The sockets in the testing sets are ground accurately to size and form automatic limit gages which indicate defective tube bases as the tubes are inserted for test. A careful visual inspection of the tubes for bent electrodes, broken welds, cracked glass, loose or broken contact studs and similar defects is carried out. In the amplifier test the tube is jarred to detect noise due to excessive vibration of electrodes or any tendency of adjacent electrodes to strike together and short-circuit. A certain percentage of the tubes are selected at random and forwarded to the National Bureau of Standards for life tests and mechanically destructive tests which show any defects of material or construction. After having passed inspection the accepted tubes are packed in cartons and sealed with an inspection stamp.

The writing of specifications and development of test methods for power tubes was in some ways more difficult than for receiving tubes. On account of the smaller number of factories involved no formal testing sets were made up, the testing equipment being supplied by the manufacturer to meet the specification requirements. The requirements of mechanical perfection of tube and base were the same as for receiving tubes. Similarly, equivalent tests for gas, insulation resistance, ruggedness, life and filament resistance were applied. Tests for operation of the tubes as oscillators were made in a standard circuit. Specified power outputs were required for varying conditions of filament and plate voltage. An overload test was made in which the tube was operated a short time at excessive input. A test was applied which caused the rejection of tubes unsuitable for operation as modulators.

In connection with the standardization of vacuum tubes and their bases and sockets it was convenient and advantageous to standardize various auxiliary apparatus. A step-up input transformer, so necessary to the use of the tubes as amplifiers, was designed specially to fit the constants of the receiving tubes. Telephone headsets were designed to have impedances which suited them for most efficient operation with the tubes. A special fifteen-cell dry battery was developed to supply plate potential for receiving tubes, while for power tubes a small 10-volt to 300-volt dynamotor was used.

The vacuum-tube work has required the services of a considerable staff of Signal Corps engineers. The following are credited with important contributions to various phases of the work: First Lieut. R. E. Bitner, First Lieut. P. T. Weeks, Second Lieut. S. S. MacKeown, Second Lieut. L. J. Stacy and Dr. F. K. Richtmeyer.

General Applications.—Two other evacuated tube devices which are not strictly vacuum tubes in the accepted meaning of this term have been classed with vacuum tubes in their development. These are the regulator tube and the ballast lamp. The former consists of a hot cathode and single, cold anode, similar in general arrangement to the Fleming valve rectifier. The latter is merely an iron-wire filament normally operating near its recalescence temperature and maintained in a low-pressure hydrogen atmosphere. These two tubes are used in the airplane radio telephone set for automatically regulating the voltage of the fan-driven generator. Attention is called to them here, particularly the regulator tube, because they illustrate in an illuminating manner one trend of development in the practical application of thermionic phenomena and the principles of vacuum-tube design to the solution of the problems connected with electrical engineering in general.

In this connection the following quotation from the editorial page of the ELECTRICAL WORLD, issue of Oct. 19, 1918, is of interest:

From a technical point of view, the most salient advance in radio engineering made since the opening of the world war has been in the construction and use of vacuum tubes. These tubes have been so far improved and so much utilized

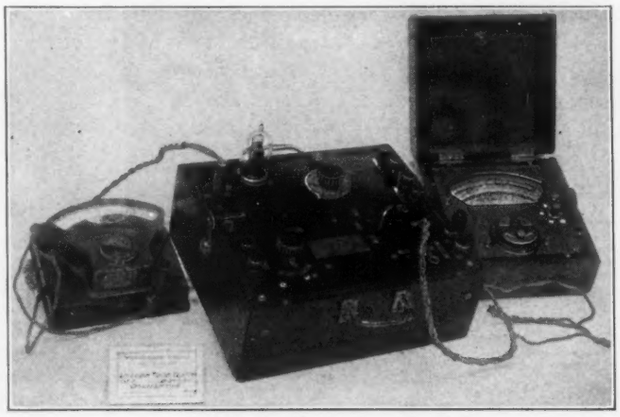


FIG. 9—STANDARD OSCILLATOR TEST SET FOR RECEIVING TUBES

for many purposes that vacuum-tube engineering seems to offer a promising new branch of electrical engineering, intimately associated with radio engineering on one side and with electric power and wire communication on other sides. It is clear that the essential theory and the principal working applications of vacuum tubes will have to be learned by most electrical engineering students. The tech-

nical colleges and engineering laboratories of the world will have to teach these subjects in the future.

Three years ago it might very properly have been said that the design and construction of the vacuum tube was far behind its application and that many valuable possibilities of use were waiting for the development of suitable tubes. To-day the opposite is true. The design of tubes to give predetermined performance is a fairly definite thing and only needs the experience of extended practical use to bring it to a high state of perfection. The feasibility of economically manufacturing tubes of desired characteristics in large quantities and with a remarkable degree of uniformity has been demonstrated.

Looking Into the Future.—While the use of the vacuum tube is as yet restricted almost entirely to the field of communication, it is to be anticipated that American engineers will not be backward in finding important applications for this unique device in the many other fields of electrical activity with which it has at present no connection and that it will soon become a common engineering tool, more familiar to the average electrician than it now is to the average scientist.

The comparative ease with which a tube of 0.25-kw. output may be constructed at once leads one to think of 1-kw. or perhaps 5-kw. tubes, and having encompassed this idea the imaginative mind easily leaps to the consideration of 10-kw. and 100-kw. installations. Where will the economic limit be reached? It is probably safe to say that aside from laboratories or experimental projects the economic limit to-day is reached in a tube approximately the size of the VT-18. As to the future, one can only guess, but the guess can be guided by limiting facts. In a well-designed tube the ratio of the alternating-current power output to the total direct-current filament and plate-circuit power input is scarcely ever greater than 20 per cent. On account of the law of space charge and the difficulty of efficiently obtaining large electron-emitting surfaces in the filament member, very high voltages must be resorted to in order to obtain large power inputs. Since 80 per cent of the total input is dissipated in heat, cooling becomes a serious problem. The combination of high voltage, high electrode temperature and large space currents makes it necessary to have a very perfect vacuum in order to avoid the destructive effects of gas ionization. Thus each difficulty aggravates the others and together they pyramid rapidly as efforts toward increased power are made. Even if the engineering obstacles could be successfully dissipated, the low efficiency and excessive cost of high-power tubes would make them questionable competitors of the high-frequency alternator or the Poulsen arc. To be sure, it is very probable that tubes of capacities up to perhaps 1 kw. will rapidly come into use as sources of continuous oscillations, since neither the alternator nor the arc is capable of effective operation at such low power or at short wave lengths. But, although a mammoth, water-cooled, all-metal vacuum tube continuously served by a high-capacity vacuum pump may be an engaging contemplation, it is hardly safe to predict that it will become a common sight in future power plants or radio stations.

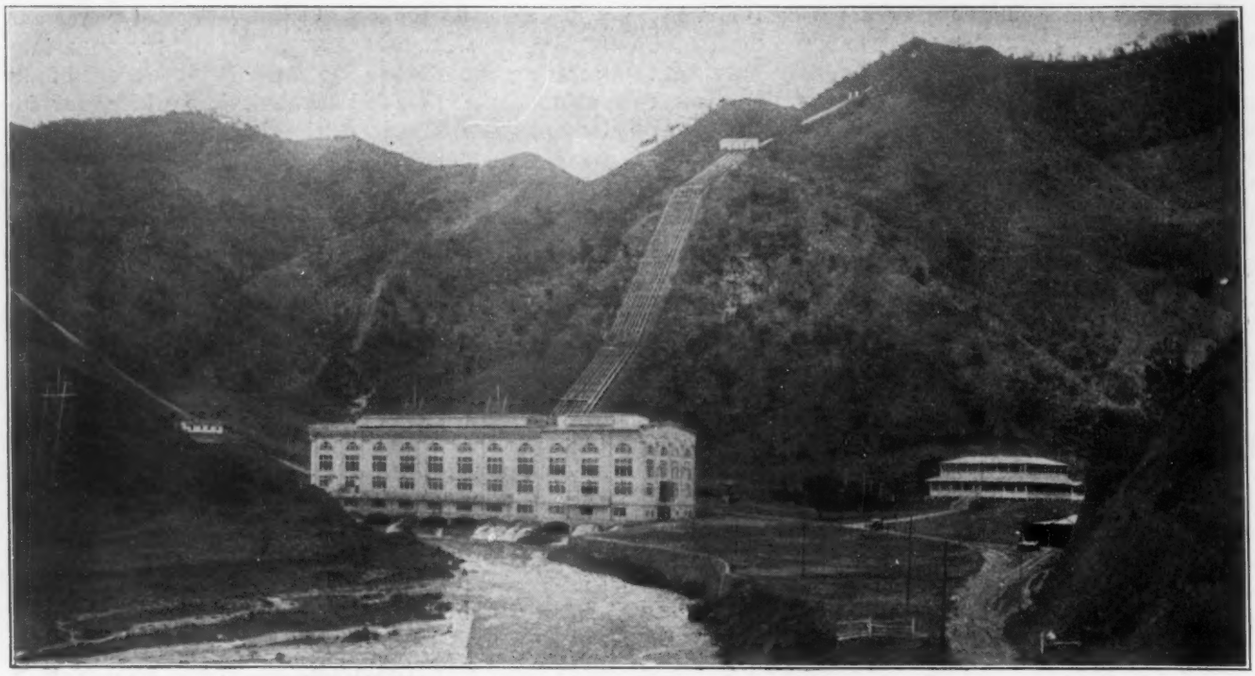
On account of the same considerations of power and efficiency it is not to be expected that the vacuum tube will to any great extent replace or improve many of the host of satisfactory electrical devices which, for instance, may be found associated with the modern city power system both at the producing and consuming ends of its lines and feeders. Its real future lies in the possibility of its revolutionizing many things which are now done in inefficient ways and in that it has made available a means for the accomplishment of many things which have heretofore been unyielding to the scientist and inventor. As an instance of the former case may be cited the recent announcement by the American Telephone & Telegraph Company that through the vacuum tube it is now able to make one telephone trunk line carry a volume of traffic previously requiring five such trunk lines. For the latter case may be mentioned the radio direction finder which, owing to the use of vacuum-tube radio-frequency amplifiers, has been changed from a scientific toy to a very useful instrument capable of locating the source of weak radio signals. The broader possibilities of the vacuum tube along such lines have been scarcely touched.

PRIZE ESSAY CONTEST IN INDUSTRIAL ECONOMICS

National Industrial Conference Board Offers Thousand-Dollar Prize for Best Monograph on Selected Subject

The National Industrial Conference Board offers a prize of $1,000 for the best monograph on any one of the following subjects: (1) A practicable plan for representation of workers in determining conditions of work and for prevention of industrial disputes. (2) The major causes of unemployment and how to minimize them. (3) How can efficiency of workers be so increased as to make high wage rates economically practicable? (4) Should the state interfere in the determination of wage rates? (5) Should rates of wages be definitely based on the cost of living? (6) How can present systems of wage payments be so perfected and supplemented as to be most conducive to individual efficiency and to the contentment of workers? (7) The closed union shop versus the open shop, their social and economic value compared. (8) Should trade unions and employers' associations be made legally responsible?

The committee of award is composed of Frederick P. Fish of Fish, Richardson & Neave, Boston, chairman of the National Industrial Conference Board; Dr. Jacob Gould Schurman, president Cornell University, Ithaca, N. Y., and Henry R. Towne, chairman Yale & Towne Manufacturing Company, New York City. The contest is open without restriction to all persons except those who are members of or identified with the National Industrial Conference Board. The copyright of the prize manuscript, with all publication rights, will be vested in the National Industrial Conference Board. Each competitor should sign his manuscript with an assumed name, sending his true name and address in a sealed envelope superscribed with his assumed name. Manuscripts must be mailed by July 1 to the National Industrial Conference Board, 15 Beacon Street, Boston. Magnus W. Alexander is managing director of the board.



HYDROELECTRIC PLANT AT LAGES, SUPPLYING RIO DE JANEIRO, BRAZIL

Market for Electrical Goods in South America—I

Industrial Characteristics of the Various Republics in the Southern Half of This Hemisphere, Together with a Brief Description of the Inhabitants, Their Habits, Their Capabilities and Their Purchasing Power

BY PHILIP S. SMITH
Trade Commissioner, Bureau of Foreign and Domestic Commerce

SO MUCH has been said and written of late about South America as a market for goods made in the United States that its importance may have been overestimated in the enthusiasm of those who are now for the first time learning about that continent. For this reason many electrical manufacturers have taken steps to enter the field in a manner that companies with more experience would call unwarranted. It is true that quantities of goods are used, and that in normal times there is a decided increase from year to year, so that it is equally unwise to underestimate the market. The aim of this article, therefore, is to present certain fundamental facts that may help the manufacturer to form an opinion regarding the extent to which he ought to push his products and something of the results he might reasonably expect.

The continent of South America consists of thirteen countries, no two of which are exactly alike either topographically, economically or politically. There is also a great difference in the characteristics of the inhabitants, their purchasing power and their manner of living. For this reason it is necessary, even in a general survey of South America as a market, to divide it theoretically into several sections and to take up each one separately. In this article, therefore, the usual custom of considering that there are three natural groups will be followed.

The first group embraces the east-coast countries of Brazil, Argentina, Uruguay and Paraguay; the second, the west-coast countries, Ecuador, Peru, Bolivia and Chile; the third, the countries on the north coast, British, Dutch and French Guiana, Venezuela and Colombia. Colombia, with its great stretch of territory on the Pacific Ocean, might be classified in the west-coast group were it not for the fact that the principal cities and the only practicable ports of entry are on the north coast.

Agentina, Brazil, Uruguay and Paraguay are, generally speaking, non-mountainous and are especially suited to cattle raising and agricultural pursuits of various kinds. Argentina and Brazil are also making repid advances industrially. All the west-coast countries are mountainous, containing the high peaks of the Andes and abounding in mines, small and large and in various stages of development. Some of the largest and most productive copper mines in the world are in Chile, Bolivia and Peru; hence much of the heavy machinery imported is for this group. On the north coast, Colombia and Venezuela have been making surprising progress in the last few years and are now taking considerable quantities of insulated wire, lamps and motors. These countries are mountainous over a large part of their territory; nevertheless, very little mining is being carried on, the sources of wealth being chiefly coffee, bananas, hides and other products of agriculture and cattle raising. Apparently the greatest development will be made along this last line. Much of the interior of both countries is unexplored. Of the three Guianas, British Guiana is the only one that consumes electrical goods, and that only in small quantities.

SOUTH AMERICAN IMPORTS OF ELECTRICAL GOODS

In 1913, the best year previous to the war, the total imports of electrical goods into South America amounted to approximately $22,250,000, and of this sum the share of the United States was $4,600,000, these figures having been taken from the statistics of the several foreign governments. It is interesting, in passing, to make a comparison of the American share with the shares of England and Germany, our two principal competitors during the same period. They were, respectively, $5,400,000 and $10,000,000. On account of the world crisis since that date the relative positions of the exporting nations have undergone a radical change, and the United States is now the leader, with exports, according to statistics compiled by the Department of Commerce, of $9,780,000 for the year ended June 30, 1918. This represents a decided increase in percentage of total imports. It will be worth the efforts that will be necessary to hold this same proportion when business shall have reached its normal point again.

Table I gives the electrical goods imports of each South American country, showing the amounts furnished by England, Germany and the United States for the calendar year 1913, the latest normal year, and the amounts sent from the United States to each country of South America for the year ended June 30, 1918.

TABLE I—ELECTRICAL IMPORTS OF SOUTH AMERICAN NATIONS

Countries	South American Imports of Electrical Goods in 1913				Exports of Electrical Goods from United States, 1917–1918
	Total	From United Kingdom	From Germany	From United States	
Argentina	$9,756,234	$3,358,711	$4,892,538	$577,126	$2,626,163
Bolivia	612,022	200,349	297,464	5,922	33,522
Brazil	8,504,518	1,420,958	2,977,488	3,239,564	3,183,016
Chile	2,288,292	346,141	1,636,215	194,834	2,162,887
Colombia	159,343	20,000	10,000	127,929	284,298
Ecuador	150,000	2,500	2,500	100,550	100,033
British Guiana	35,000	10,000	10,000	10,000	41,372
Dutch Guiana	.....	.....	.....	.....	1,435
French Guiana	.....	.....	.....	.....	308
Paraguay	82,914	17,090	27,027	5,496	22,929
Peru	223,958	9,235	74,115	126,233	647,296
Uruguay	230,708	30,745	49,846	49,431	438,114
Venezuela	207,503	25,000	5,860	137,933	238,724
Total	$22,250,492	$5,440,729	$9,983,053	$4,575,018	$9,780,097
Per cent	100.0	24.0	40.4	20.5	.....

LOWER PURCHASING POWER OF SOUTH AMERICA

The mistake is often made of taking it for granted that the average consuming capacity per capita is the same in South America as in North America. This is not true, and any selling estimate or campaign based on such a false assumption is bound to result in disappointment. Briefly, the principal reason for this is that the South American countries being still in the pioneer stages of development, the desires for modern luxuries or even conveniences are not yet so strong as in some other parts of the world. Moreover, as the wages paid are on a lower scale, while the prices of all imported articles are much higher than those of the country of origin, owing to the freight, duty and other expenses incidental to importation, many things are quite out of reach of the greatest part of the inhabitants even if they were educated up to their use. As an illustration of this situation, we may take the case of Peru, with a population of 4,500,000, of which it is estimated that 50 per cent are Indians, 35 per cent are half-breeds, negroes and Chinese, and only 15 per cent belong to the white race. Looked at in a most liberal manner, Peru as a market for electrical goods is no better than an American purchasing public of 100,000 people. This includes both the people as a whole and the foreign mining interests, whose annual business is a large proportion of the total. This is one of the extreme cases, but the same sort of allowances must be made for all countries. Those composing group 1 have the greatest purchasing power, the maximum being found in Argentina.

TABLE II.—STATISTICAL DATA ON SOUTH AMERICAN COUNTRIES

Countries	Area, Square Miles	Population	Equivalent Population in United States*
Argentina	1,153,400	8,000,000	3,250,000
Bolivia	514,464	2,535,000	200,000
Brazil	3,301,950	25,000,000	2,800,000
Chile	290,000	3,800,000	760,000
Colombia	494,340	6,000,000	55,000
British Guiana	89,420	300,000	6,000
Dutch Guiana	46,352	90,000	.....
French Guiana	31,550	50,000	.....
Ecuador	275,331	1,500,000	50,000
Paraguay	164,090	750,000	30,000
Peru	680,000	4,500,000	100,000
Uruguay	72,057	1,250,000	85,000
Venezuela	394,154	3,000,000	75,000

* This equivalent is based on the 1914 Census of Manufactures, which places the value of electrical machinery, apparatus and supplies made in the United States at $359,432,155. Allowing for an exportation of $30,000,000 and a population of 100,000,000, the domestic per capita purchase of electrical material is $3.29, while in South America, it is less than 50 cents.

Table II gives the area of each country, its population and its estimated purchasing power expressed in terms of an equivalent population in the United States.

BRAZIL

Growing Demand for Electrical Goods.—The consumption of electrical goods in Brazil is steadily growing, and before many years it will surpass that of any other South American country. With a population of approximately 25,000,000 and resources of a very varied character, Brazil will have a more diversified demand than it has at present. Mines will be developed, numerous industries have been established already, and steam railroads will be electrified.

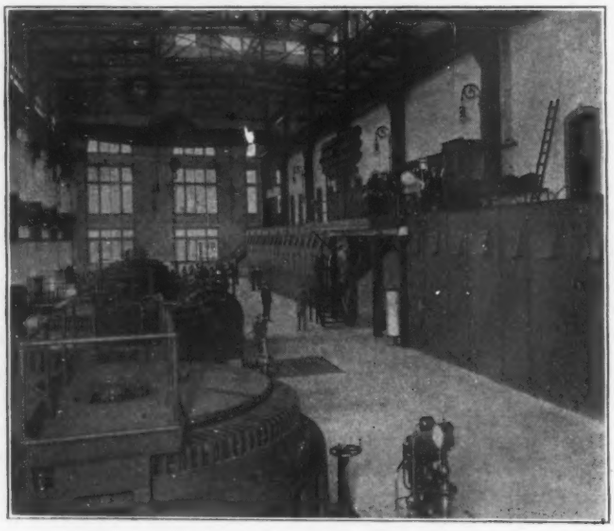
Two of the largest and most progressive central stations in Latin America are situated one in Rio de Janeiro and the other in São Paulo. These are both owned and operated by the Brazilian Traction, Light & Power Company, Ltd., a Canadian company, largely under American managers and engineers. Its policy has been always to encourage the use of high-class material, and consequently standard American goods have had a ready sale in the district covered by its lines. This provides a good illustration of the advantages that American industries can expect to derive from the investment of American capital in foreign countries.

Electrical Power in Industry—Mining—Electric Railways.—An indication of the extent to which electric power is used in the industrial life of Rio de Janeiro and São Paulo will be had from the statistics of the central stations, which show that in São Paulo there

is more than 50,000 hp. in electric motors connected to the circuits, while in Rio de Janeiro there is more than 100,000 hp. connected. The normal yearly increase may be taken at not less than 5000 hp.

Already there are a number of mines in operation, and indications are that in the near future active work will be begun in the great iron-ore district in the State of Minas Geraes. Judging by the size of the known deposits and the importance of the companies owning them, it is evident that when this development takes place there will be required a large amount of modern mining and power machinery.

The railway that will tap this iron-ore district, known as the Victoria-Minas Railroad, will be electrified for a length of several hundred kilometers. Plans have been



INTERIOR OF 85,000-KW. PLANT AT LAGES, BRAZIL

completed already for electrifying a large portion of the Paulista Railroad, in the State of São Paulo, and other roads are expected to follow this example.

Power from Waterfalls.—The power for all these enterprises will be furnished by waterfalls, which are abundant in this particular section of Brazil. The country rises rather abruptly from the seacoast to a height of several hundred feet, and the interior uplands form a great drainage basin for rivers and streams that fall precipitately to the Atlantic coast. Many of these have been harnessed and are furnishing energy to a great many towns and cities. Some are capable of producing only a few hundred horsepower, but it is interesting to note that there are also streams from each of which, it is estimated, thousands of horsepower can be obtained. Three of the largest of these are the Sete Quedas, with about 20,000,000 hp.; the Iguassu, with 3,000,000 hp., and the Paulo Affonso, with 1,500,000 hp. The first two, however, are so far removed from industrial centers that they are not susceptible of development unless some means is provided for the utilization of electricity on a large scale.

Telephones—Street-Railway Systems—Household Devices.—There are a number of telephone companies, some of which are provided now with modern equipment, although most of the smaller ones will be needing new material to take care of their natural expansion. The more important companies are in Rio de Janeiro and São Paulo and are owned by the Brazilian Traction, Light & Power Company. They have about 40,000 subscribers and use only American material. Their yearly increase is approximately 10,000 instruments in service, most of which are European-made.

There are street-railway systems in Manaos, Para, Ceara, Bahia, Rio de Janeiro, Nictheroy, São Paulo, Santos, Porto Alegre, Pelotas and Rio Grande. With the exception of the last, which is a very small company, they all use English or American equipment exclusively. The total number of motor cars in active service is about 1500.

The small household devices used for heating and cooking are being introduced energetically and will enjoy an increasing popularity with dealers in electrical goods. In all the cities the dealers are very progressive, and both they and the central stations are engaged in active propaganda for the wider use of electrical material of all kinds.

ARGENTINA

Prospect of Rapid Development—Lack of Water Power.—At the present time and perhaps for the immediate future Argentina offers the best market in South America for electrical goods, owing to the fact that it is capable of easy development and produces articles of such prime necessity throughout the world as grain, wool and beef. It is expected that its progress will be more rapid than that of other countries that have more difficult transportation and production problems, and its point of maximum ability to absorb electrical goods will be reached while Brazil is still in the early stages of its development.

Argentina is handicapped in not having available for development any large amount of waterpower. Several of the interior cities, such as Tucuman and Cordoba, have hydroelectric plants, but these are furnishing practically all the power of which they are capable. The only large waterfall is the Iguassu, half of which may be ceded to Argentina, since it is on the boundary between that country and Brazil. As was pointed out, however, this is too far away to be of any use in the industrial development of either country.

Industrial Uses of Electricity—Central Stations in Buenos Aires.—There is a great deal of interest in local manufacturing, and government as well as private associations are attempting to increase it as much as possible. There is already approximately 130,000 hp. in motors in active operation, and the yearly increase for the last few years has been about 6000 hp. According to statistics, it would appear that there is at least 150,000 hp. in steam and gas engines in various industrial establishments, most of which are within the reach of central-station power.

There are two large central stations in Buenos Aires, the larger of which is a German company, with an installed capacity of approximately 100,000 kw. The smaller station is owned by a combination of Italian and Swiss manufacturers, and both these central stations are practically committed to the exclusive purchase of European goods, thereby indicating again the influence of invested capital in obtaining trade for the home country. The German company also has invested approximately $24,000,000 in other stations throughout Argentina. Its parent company owns one of the

tramways in Montevideo and the central stations and tramways in Valparaiso and Santiago, Chile.

Telephones—Street and Other Railways.—A large number of small telephone companies operate in the various towns and cities and have a total of approximately 50,000 subscribers. The better companies are using American material almost exclusively, with English and German motors and controllers. Many extensions are contemplated, and the repair and supply business is one of considerable volume.

One of the steam roads has electrified one of its suburban lines for a distance of 30 km. and contemplates further electrification in the near future. Two other railways have made some progress toward electrification, one of them having installed its power plant and third rail. All these are English-owned companies and employ a firm of English consulting engineers to take charge of this work.

Increasing Variety of Devices on Market—Lack of Wiring Rules.—The retail dealers in electrical goods are progressive and handle all kinds of miscellaneous devices, as well as standard lines of wire and wiring supplies. These two items are the principal lines in the electrical trade, but with the assistance of the central stations there is being created a demand for heating and cooking devices and the more modern forms of lighting equipment.

There are no wiring rules or regulations to require the use of material of such high grades as the American standard goods, and the European factories for a long time have been making propaganda in favor of cheaper material, with the result that this market is one where cheap goods have the greatest sale and arguments concerning quality have little effect.

URUGUAY

Limitation of Market to Montevideo.—There is little of interest in Uruguay outside the city of Montevideo, since the central stations in the interior are of very small capacity and many of them operate only during the night time, which practically excludes all household devices and motors.

There are no waterfalls, as the country is comparatively flat. It is devoted almost entirely to agriculture and stockraising, though mining is attracting more attention than formerly on account of traces of a large variety of ores. Industrial progress is being fostered by the government, but it is hardly to be expected that it will ever reach great proportions. Exception may be noted, however, in the matter of the meat-freezing industry, several plants having been erected by United States companies.

Central Stations Owned by Government Telephone Companies.—The government of Uruguay owns, or will own, all the central stations, and consequently all business in connection with them may be done with the central office in Montevideo. This government department of central stations is unusually progressive and maintains attractive and well-equipped display rooms in which it demonstrates all grades of household devices. It also makes special rates for the energy used in cooking ranges, and the effect of its attitude has been to stimulate dealers into greater activity in the display of such material.

The telephone companies, of which there are approximately twenty, are now owned privately, but the government intends to take them over, under its policy of declaring all public utilities to be state monopolies. There are approximately 18,000 instruments in use, of which 10,000 belong to the two companies operating in Montevideo. The larger of these, an English company with 8000 subscribers, uses American material.

Street Railways—Municipal Lighting—Trade Methods.—There are two street-railway companies with 400 cars. The government has bought a mule-car line and intends to electrify it in the near future.

Montevideo is one of the few cities still lighted by arc lamps, of which there are now approximately 2000 in service. It is expected that these will be replaced by a system of incandescent lighting before very long.

Much of what was said about Argentina is true also of Uruguay, and the business in the latter country is handled usually through the representative or branch office in Buenos Aires. It is hardly of sufficient importance to require an independent agent, responsible to the factory direct.

CHILE

Good Prospects of Development—Power Project.—Although one of the smaller countries, Chile offers one of the best three markets for electrical goods. It has large and active mining development, and quantities of electrical material are employed in its nitrate fields. Many industries have been established under the stimulation of the abnormal conditions of the last few years, and everything possible is being done to extend them.

In the section from Coquimbo to Valdivia there is an abundance of water power, and the government has created a commission to study the possibility of constructing a longitudinal artery for the transmission of power throughout this stretch. If this can be done successfully, it will make available a large amount of cheap power, which, in turn, will greatly encourage the establishment of more industries.

Central Stations—Telephones—Railroads—Business Methods.—The two larger central stations are in Santiago and Valparaiso, and since they are owned by German capital their whole influence has been used to exclude material other than of German manufacture. Presumably they will continue the same policies.

There are several smaller independent telephone companies, but most of the more important places are controlled by the Chile Telephone Company, an English concern with headquarters in Santiago. They are preparing to replace much of the older equipment with more modern material.

The Chilean government has taken steps already looking toward the electrification of three sections of its railway system, and if the entire program is carried out, it will mean the installation of a large quantity of generating and power apparatus. This subject has been discussed for ten years or more but will probably be brought to a successful conclusion eventually.

Owing to the fact that business cannot be handled from one central point, as in Argentina, there are fewer exclusive electrical dealers, this business being handled by the central stations or by hardware and machinery houses. It is necessary to have representation in several of the important cities, each of which is a purchasing center for the surrounding district.

COLOMBIA AND VENEZUELA

Although the characteristics of Colombia and Venezuela are far from identical, they may be considered as one, since many of the statements applying to one apply also to the other. They are noted more for their agriculture and allied industries than for their mines, with the possible exception of the gold and platinum and emerald producing region of Colombia. Some power machinery has been installed for the extraction of gold, but in general mining is done by hand labor.

There are many small central stations scattered through the interior, and the number is constantly being increased. There are numerous small waterfalls that can be used for developing electric power for the nearby towns, as well as several large sources of power that could be used only if energy-consuming industries were to be established near them.

Owing to the difficulties and expense of traveling, it is desirable to secure active local representatives rather than to attempt to cover the field with factory representatives.

PERU

Electric power is used in the large and small mines of Peru, the oil fields and the sugar plantations, all of which are following a program of expansion as fast as conditions will permit. In or near Lima a number of small industries also use electric power, and the central station is quite active in securing new customers.

The street-railway system in Lima and Arequipa and the telephone company in Lima use American material exclusively. The Central Railroad has been making studies of the electrification of its line, but apparently has not found that conditions warrant such a movement.

A great majority of the inhabitants are Indians and halfbreeds, living in the high inland plateau, so that the consumers of household and miscellaneous devices are not more than 15 per cent of the population.

[The second part of this article will deal briefly with Ecuador, Bolivia and British Guiana and will give a résumé of the facts brought out, together with a tabulation of central stations in some South American countries.]

Pull Together to Decrease Accidents

Co-operation Between Employer and Employee Will Increase Production and Efficiency and Will Reduce Accidents—Safety and Welfare Committees Should Be Formed and Should Encourage Suggestions

BY F. B. VAN DOREN
Safety Engineer, Utilities Mutual Insurance Company

CO-OPERATION is essential in all phases of successful living, and perhaps nowhere more so than in the work of preventing accidents. Of the safety-first idea it is the quintessence. The meaning of coöperation is "concurrent effort or labor," and there are at least two viewpoints from which to observe its accomplishment. One is the employee's and the other the employer's.

"Pull-together" spirit between employer and employee will not only increase production and efficiency but it will beyond any question decrease the number of accidents. Visit any public utility plant where the "pull-together" idea exists and inquire what its accident experience has been for the past year. One would not have the least hesitancy in saying that it has been exceedingly low. Then visit the plant where little or no coöperation exists, and one will find dissatisfaction, discord, low efficiency and numerous accidents.

Every one must have seen plants where the attitude of the employee is: "Why should I care? The boss doesn't care anything for me except to get ten or twelve hours' work. Why when we leave the shop he never thinks of us again." Do you suppose such a company is getting what it should in production, or what it would if some thought were given to the other fellow?

That employer who has no thought for his employees after working hours will sooner or later find the better employees seeking employment elsewhere, and the others reciprocating the feeling. His accident record will not only be high, but his labor turnover also will be high.

Most men are born sociable and appreciate it when a good word is spoken to them. You can call it what you please—salve or blarney; nevertheless, from the highest to the lowest they like it.

It should not be inferred that an employer should be insincere; that would mean disaster. But to give out words of good cheer and have them come from the heart works wonders. It will be found to pay large dividends in many ways.

Where it is the practice for the owner, manager or superintendent to make a daily inspection of the property he should never go into it with a "grouch." Put on the "Sunny Jim smile" and say "Good morning" to Jim, George or Bill. These men are human, and a personal acknowledgment means a great deal to them. It makes them feel as if they were part of the organization and not a machine.

No longer should any gap exist between the employer and employee. The "get-together" spirit has arrived. The first to adopt it will be the one not only to hold his old employees but to have a waiting list, and he will find also that he has the most efficient organization.

Let none of us forget that it is the man with the flannel shirt and overalls who brings in the dollars. There is an old but true saying, "Never judge a man by his clothes." Underneath many a ragged and soiled suit lies a heart of gold.

If sickness or injury comes to one of your employee visit his home. See if he or his family is in need. This cannot always be done by the employer himself, but he

can appoint some good person in his organization to do it. He will find it will never be forgotten by either the man or his family, and returns will follow beyond expectation.

Coöperation or the "pull-together" spirit must be strictly adhered to if accidents are to be kept at a minimum. The management of any concern will have no trouble from this cause if it will show that it is interested in the welfare of its employees. Follow the golden rule, "Do unto others as you would have others do unto you," and no trouble will be experienced.

Do not drive men. The man of to-day can think for himself and if driven will resent it in many ways. Try to lead, and see if the outcome will not be more satisfactory. "You can always catch more flies with molasses than vinegar."

Mistakes are bound to occur, but do not lose sight of the fact that nothing was ever accomplished without them. He who never makes mistakes gets but little. How many of us have ever tried to assign the reason when an employee has made some mistake? At the time his mind may have been occupied elsewhere; perhaps he has had trouble at home. These cases should be investigated, if possible, and help furnished so the man may know that while he is at his labors his family is being taken care of.

Coöperation among employees may be attained by the appointment of safety and welfare committees, and these should freely encourage suggestions. Do not lose sight of the fact that in many instances an employee holding one of the lowliest positions may be able to offer the best suggestion, which, if adopted, would be the means of preventing serious accidents and at the same time improving the efficiency of the plant and increasing the production.

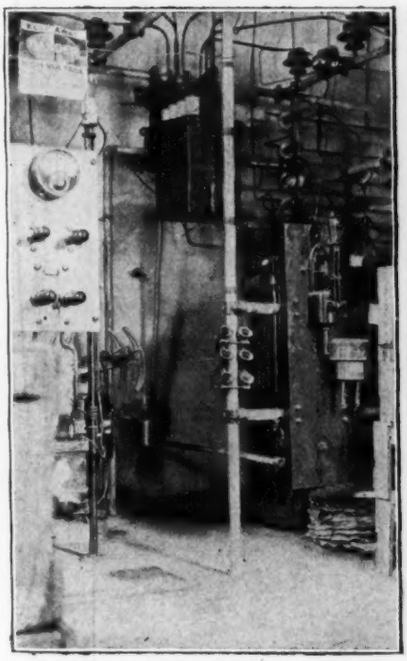
If the confidence of the employees is once gained, it is an easy matter to hold it. Before it can be held, however, one must lay all the cards on the table and be absolutely honest and sincere. Confidence once lost is very hard to regain. Employees are not slow to resent dishonesty, and if practiced it will soon cause trouble. Honesty is the best policy with employees and public alike, and it will be found to pay large dividends.

COÖPERATION FROM THE EMPLOYEE'S STANDPOINT

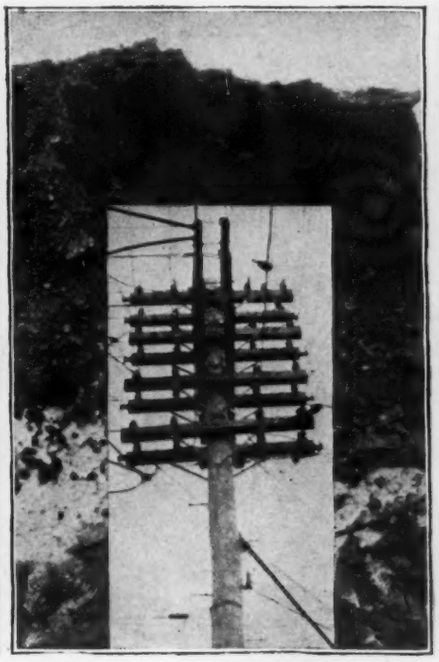
Now let us look at coöperation from the standpoint of the employee. Coöperation is a fifty-fifty proposition, and each must act accordingly. The employee must do his part if the management is expected to do its part. He must give an honest day's work, be punctual in his attendance and carry on his regular duties for the best interest of his employer. He must use the safety appliances furnished and strive in all ways possible to help educate his fellow workers along safety lines. He must remember that the management is operating the plant to obtain a livelihood as well as pay a fair return on the investment.

If the employee is looking for nothing beyond his daily labor and watches the clock instead of keeping his mind on his duties, the employer will soon lose faith in his desire to obtain coöperation. The labor turnover will be increased, and accidents will occur more and more frequently, with an increased loss to both employer and employee.

If each will look at it from his own side, he will soon see the error of his ways and will try to encourage the "pull-together" spirit at all times. The sooner both management and employee realize this, the sooner dissatisfaction, discord and strikes will come to an end. In their place greater production, greater efficiency and fewer accidents, with entire satisfaction for all, will result.



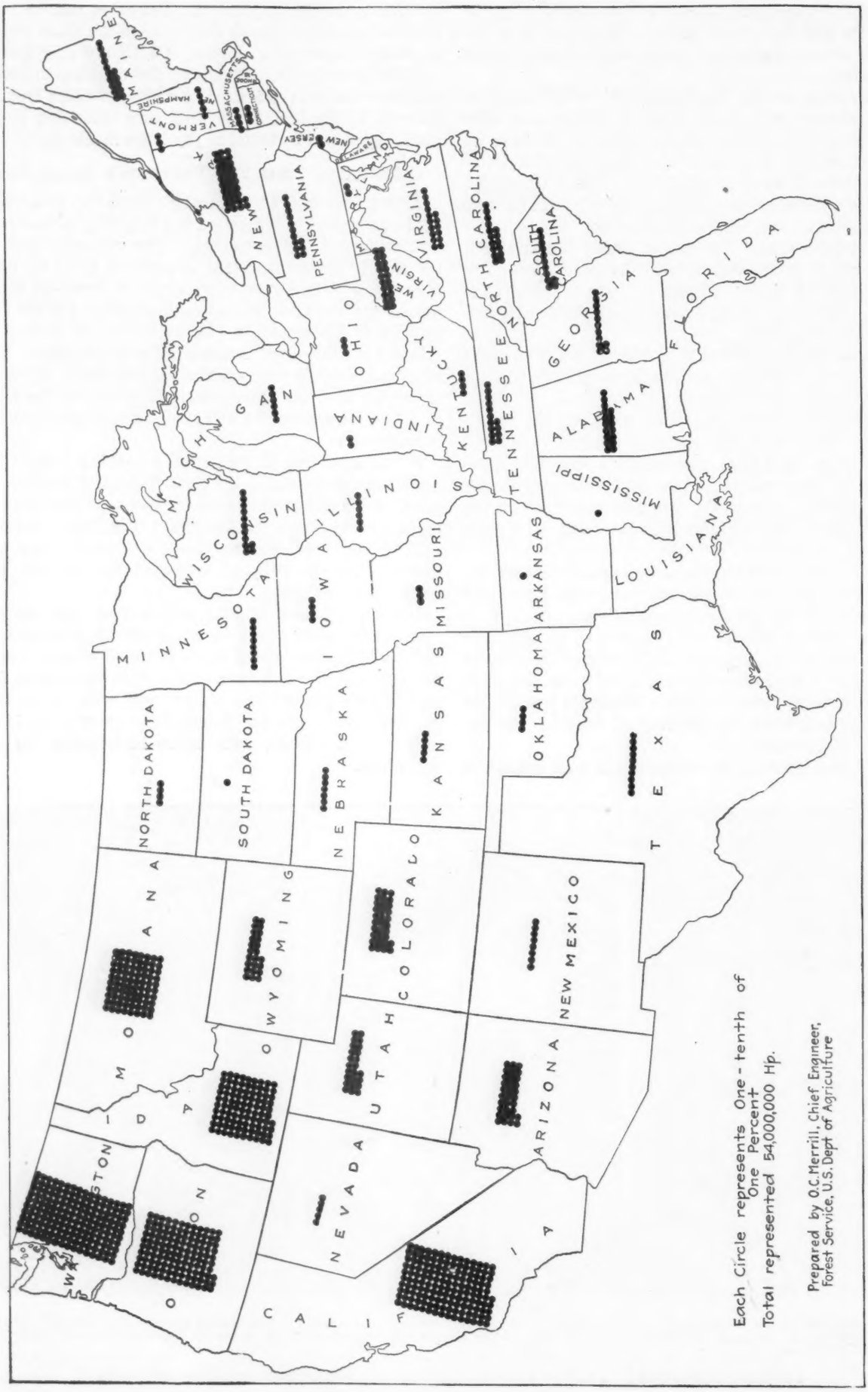
Surplus material should be removed for reasons of safety as well as better operating conditions.



Overhang in a coal pile may be the cause of accidents. Poles should have plenty of climbing space.

Removal of surplus material and storage in separate building is good operating practice.

FREQUENT INSPECTION BY THE EMPLOYER AND CARE BY THE EMPLOYEE WILL LESSEN ACCIDENTS



MAP SHOWING DISTRIBUTION OF WATER-POWER RESOURCES IN THE UNITED STATES

Economic Aspects of Industrial Lighting

Cost Versus Wages—Increased Production and Greater Accuracy in Workmanship—Reduced Accidents—Less Eye Strain—Stimulating Effect—Comfort of Workmen—More Neatness

BY C. E. CLEWELL
Assistant Professor of Electrical Engineering, University of Pennsylvania

In this and the two preceding articles the endeavor has been made to point out and summarize a number of valuable features in the industrial lighting problem, some of which have resulted from intensified studies during the war emergency. In the present discussion the principal emphasis is placed upon the economies which good lighting may effect, and it is endeavored to illustrate by several actual cases the excellence which may be obtained by the modern system. In the inspection of the views shown it should always be kept in mind that the illustrations represent conditions existing where the lighting system has been carefully designed and that these conditions do not exist in a great proportion of the industries, so that continued efforts toward improvements are needed in many directions.

THE fundamental importance of adequate light in industrial plants has long been recognized by engineers, but only within the last few years has it come to be a fairly well-accepted idea on the part of plant managers in this country. To verify the first part of this statement it is only necessary to refer back to the analysis of artificial lighting costs in terms of wages set forth in 1910 by Prof. Charles F. Scott in which a new viewpoint was taken as regards industrial lighting.[1] Thus nearly ten years ago the idea of evaluating lighting costs to an equivalent proportion of the wages in a given shop section was advanced as a practical working basis for looking at the value of good light under industrial conditions.

It is to be noted carefully that this original statement referred to the cost of good lighting in terms of the wages in a given section for so many minutes per day. The idea back of this plan was that if the total cost for the best form of lighting was equivalent to the wages in a given shop for, say, five minutes per day, a loss of, say, five minutes per day for each workman due to inadequate light and the saving of this time by good light could readily be looked upon as tending to show that the improved lighting system was economically well worth while. Such an analysis of proposed lighting systems has often proved to be an invaluable aid in convincing those responsible for the expenditures that the installation of a new system is necessary.

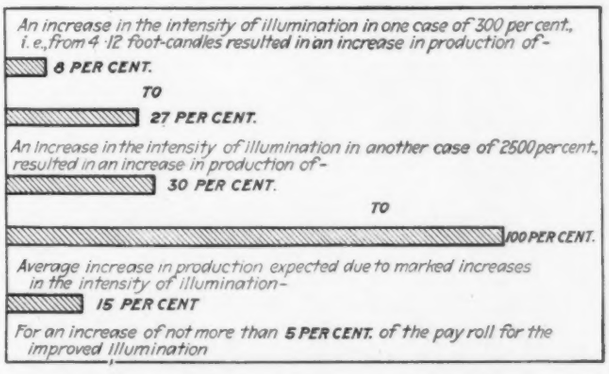

An increase in the intensity of illumination in one case of 300 per cent., i.e., from 4 to 12 foot-candles resulted in an increase in production of-
8 PER CENT.
TO
27 PER CENT.
An increase in the intensity of illumination in another case of 2500 per cent., resulted in an increase in production of-
30 PER CENT.
TO
100 PER CENT.
Average increase in production expected due to marked increases in the intensity of illumination-
15 PER CENT
For an increase of not more than 5 PER CENT. of the pay roll for the improved illumination

FIG. 1—GRAPHICAL REPRESENTATION OF INCREASES IN PRODUCTION WHICH HAVE BEEN EXPERIENCED AFTER MARKED INCREASES IN THE ILLUMINATION*

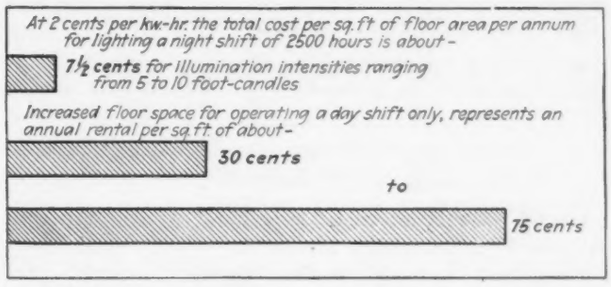

At 2 cents per kw-hr. the total cost per sq. ft. of floor area per annum for lighting a night shift of 2500 hours is about-
7½ cents for illumination intensities ranging from 5 to 10 foot-candles
Increased floor space for operating a day shift only, represents an annual rental per sq. ft. of about-
30 cents
to
75 cents

FIG. 2—COMPARISON OF COST OF LIGHT PER SQUARE FOOT WITH THE PROBABLE RENTAL COST PER SQUARE FOOT FOR INCREASED FLOOR SPACE FOR AVOIDING A NIGHT SHIFT.

It has not been uncommon during the last few years to find plants where an expenditure of the equivalent of the wages of five or six minutes per day for an improved lighting system has been the cause for reducing losses of time of five and ten times the cost of the improved light, thus greatly increasing the appeal of the argument outlined above. It is to be observed, however, that in the past it has been necessary to estimate roughly the time losses under the older and inferior lighting system, often based on opinions of foremen or superintendents in given shop sections. The improvements brought about by the new system have thus practically always been rough estimates and rather of a qualitative than of a quantitative nature. Notwithstanding this rather unsatisfactory aspect, these estimates have often been of great use in arriving at the probable value of a new lighting system to a plant, and they have usually appealed very strongly to the plant management.

From a slightly different angle a number of items have been set forth in the form of a summary of the objects to be gained by good lighting under the following heads: (1) Increased production for the same labor cost, (2) greater accuracy in workmanship, (3) reduced accidents, (4) less eye strain, (5) more cheerful surroundings, (6) greater comfort for the workmen, and (7) more order and neatness in the shop.[2]

Here again an effort is apparent so to classify the advantages of good lighting that any shop manager could by a study of these items in conjunction with the needs of his plant become convinced of the value of good light and consequently be likely to view favorably the necessary expenditures for a new installation. While the scheme of analysis advanced by Professor

*Fig. 1 is designed on a basis of data reported by W. A. Durgin, and Figs. 2 and 3 by Ward Harrison. Fig. 4 is due to the Edison Lamp Works and Fig. 7 to the Ivanhoe Regent Works, both of the General Electric Company, and Figs. 5 and 6 to the Cooper Hewitt Electric Company.

[1] Editorial in the *Electric Journal*, May, 1910.

[2] "Factory Lighting," McGraw-Hill Book Company, 1913, p. 1.

Scott in 1910 and the summaries of the advantages of good factory lighting which have appeared from time to time have proved by their results that they filled a certain need in the propaganda for better industrial lighting conditions, there has long been felt the need for more tangible and definite data on the advantages of good versus poor illumination in the shops.

The fundamental and far-reaching question which would naturally arise in the mind of the typical shop

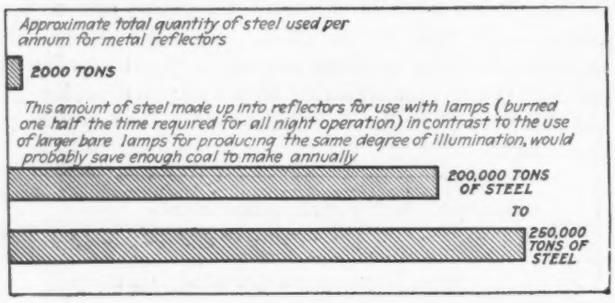

Approximate total quantity of steel used per annum for metal reflectors
2000 TONS
This amount of steel made up into reflectors for use with lamps (burned one half the time required for all night operation) in contrast to the use of larger bare lamps for producing the same degree of illumination, would probably save enough coal to make annually
200,000 TONS OF STEEL
TO
250,000 TONS OF STEEL

FIG. 3—AN INTERESTING ASPECT OF THE ECONOMY IN THE USE OF EFFECTIVE REFLECTORS

manager when contemplating a new system would be: By how much will the production of my plant be increased by a new and modern lighting system? This question, which is certainly a most reasonable one, has in the past been practically impossible to answer definitely owing to a lack of accurate data on the subject, and the lack of data has certainly to a considerable degree been due to the obvious difficulties in the way of securing such information. It is true that estimates have been made in the past on how much the production might have been increased, roughly, by a new system of lighting, but such estimates have been unsatisfactory to the extent that they were estimates unverified and often practically impossible to verify.

The foregoing comments will indicate some of the reasons why the tests conducted recently by the lighting committee of the Commonwealth Edison Company for the purpose of determining accurately the increase in production due to marked increases in the intensity of illumination furnished given classes of work have proved to be of such fundamental interest to the profession. In fact, it is difficult to form an estimate at this time of the intrinsic value of this kind of data to the immediate future of the industrial lighting field. With all the efforts which have been made to improve lighting conditions in the industries during the last ten years, it is easy to see that the progress in this field has been very discouraging and the improvements slow, except perhaps in certain more or less exceptional cases throughout the country, taking it as a whole. No one interested in this field, therefore, can be other than gratified at the appearance of these data, which, so far as the writer is aware, are among the first definite notes of this kind thus far published.

The results of these Chicago tests were first mentioned very briefly by Preston S. Millar in his paper on "Lighting Curtailment" in February, 1918,[3] and later in more complete form by William A. Durgin in his important contribution on "Productive Intensities" in October, 1918,[4] and it is very desirable at this point to mention briefly several of the more important aspects of these tests reported by Mr. Durgin, together with some of their more fundamental results.

The difficulty in the way of making tests to determine accurately the increase in production due to improved lighting as suggested above is emphasized by Mr. Durgin, who points out that the program for the remaining Chicago tests includes a four months' run, the first month to consist of observations with the lighting as it exists, a second month to be given over to a study of production after the installation of a good lighting system (providing an intensity 50 per cent higher than that recommended by the code of the Illuminating Engineering Society as a maximum for the given class of work), a third month to be given over to similar studies for an intensity corresponding to the lower specification of the code for ordinary practice, and a fourth month to observe production at the same high intensity of lighting as that of the second month.

The fundamental requirements for such a test have been summarized as an accurate tabulation of the plant production records throughout the test and the performance of a reasonable amount of work during the night hours. The two chief difficulties encountered in the realization of these points have been to locate plants having an effective system of production records and to persuade the management to operate after the second month at a lower intensity than that employed during the second month, particularly after the many advantages of the higher intensity have begun to be realized. Considering these very real difficulties in the way of such tests, it is particularly interesting to note that thus far data have been secured at two plants which point to a conclusion favoring higher intensities than those recommended by the I. E. S. code.

In fact, the tests in these two plants have shown in the first instance that an increase in the illumination

FIG. 4—SHOP WITH METAL-REFLECTOR LAMPS

An average intensity of 5 foot-candles is furnished in this shop by 150-watt Mazda lamps in metal reflectors. The lamps are 13½ ft. above the floor and are spaced 15 ft. apart.

from 4 to 12 foot-candles at the work resulted during the month of the higher intensity in from 8 to 27 per cent higher production as an increase over the previous month with the lower intensity. These data are shown graphically in the upper part of Fig. 1. This test was

[3] *Transactions I. E. S.*, Vol. XIII, No. 2, p. 123.
[4] *Transactions I. E. S.*, Vol. XIII, No. 8, p. 417.

conducted in a machine shop, and, as might have been expected, the superintendent of the plant extended the practice of the higher intensity to other sections of the factory after its value in one section had been so convincingly established.

In another instance, where bare lamps had previously been used, a general lighting system was installed with

FIG. 5—AN INSTALLATION OF MERCURY-VAPOR LAMPS IN AN AUTOMOBILE PLANT

an increase of about twenty-five times in the illumination. Here Mr. Durgin reports an increase in production ranging from 30 to 100 per cent in the several operations of the shop. Observations, in lieu of accurate tests, have been made in nine other plants, and a general conclusion has been drawn that marked increases in the illumination provided for industrial operations are capable of increasing production around 15 per cent, with an increase in the cost of lighting of not more than say 5 per cent of the payroll.

Among the opinions which have been advanced by leading authorities since the announcement of these Chicago tests has been the idea that there is a stimulating effect in higher intensity lighting, which is a factor worth careful consideration in addition to the mere question of being able to see more clearly.

These tests and the comments made upon them have proved most interesting in their important relation to the whole question of industrial lighting. The results, which clearly show positive increases in production, appear convincing and applicable to problems which must be faced in the immediate future in this field. It would appear, however, that the tests made thus far are merely a beginning of studies which should be made.

No one who has given close study to the important question of how much light should be used for a given demand upon the eyesight can well have failed to consider how many-sided this question is in practical cases. Tests of the kind reported from Chicago certainly point to the great value which may result from the accumulation of as much information as possible of this general nature as an aid to the intelligent specification of intensities for given processes and operations. There is undoubtedly much room for further researches into this field, and it is to be hoped that the lighting committee of the Commonwealth Edison Company will continue these tests and make reports upon the results.

Another aspect of lighting economy has been touched upon recently in the relation of lighting costs to the rentals of increased floor space where a plant expands and prefers the increase of its floor areas with day shifts only to the use of night shifts in existing shops with the use of artificial light.[5] It has been shown in this connection that where the intensities of artificial light should range from 5 to 10 foot-candles, 1 watt per square foot (11 watts per sq.m.) of floor space is the approximate requirement, and that with a rate of 2 cents per kilowatt-hour, the total annual cost for lighting would amount to about 7.5 cents per square foot (85 cents per sq.m.) of floor space, where the night shift amounts to, say, 2500 hours per year. On the other hand, the elimination of the night shift and an extension of the plant to a larger size so as to increase the day shift has shown annual rental charges

FIG. 6—A LARGE FOUNDRY ILLUMINATED WITH MERCURY-VAPOR LAMPS MOUNTED WELL OVERHEAD

[5]Ward Harrison, *Transactions I. E. S.*, Vol. XII, No. 8, pp. 420 and 421.

of 30 to 75 cents per square foot. These figures, when compared with the lighting charge of 7.5 cents per year per square foot, form the basis for some very interesting conclusions. Fig. 2 represents these relations graphically.

One of the interesting facts brought out by the notable paper of W. A. Durgin previously mentioned was the relation of the gross metal used for reflectors and the corresponding economy of these reflectors.[6] This, obviously, has a bearing upon the general question of lighting economics. The comparison was made to disprove the erroneous impression in some quarters that the suspension of the manufacture during the war

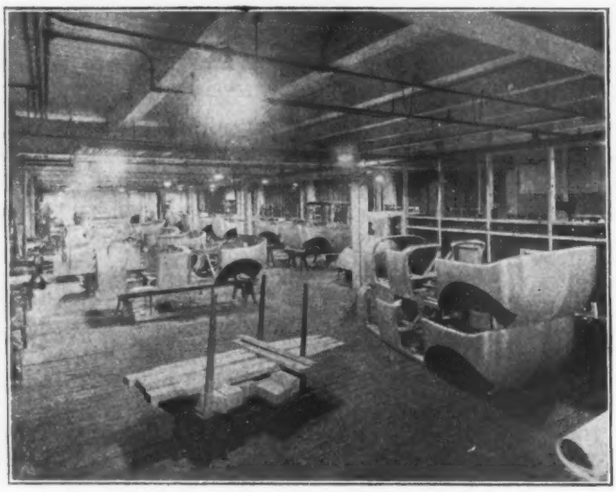


FIG. 7—A GENERAL LIGHTING SYSTEM WHERE DEEP-BOWL METAL REFLECTORS ARE USED

of all metal reflectors would be beneficial in adding to the available steel supply.

It has been pointed out, however, that whereas about 2000 tons of steel are used per annum for the manufacture of metal reflectors, the saving in coal through the use of these reflectors with relatively smaller lamps, in contrast to the use of larger bare lamps, might reach an amount sufficient to produce from 200,000 to 250,000 tons of steel annually. This conclusion, while relating to a war consideration primarily, has brought out in a very striking manner one of the ways in which the importance of reflectors for industrial lighting systems may be viewed, and hence forms an item of value in the consideration of this subject, irrespective of its war interest in the first instance.

[6]Discussion by Ward Harrison, *Transactions I. E. S.*, Vol. XIII, No. 8, p. 425.

SMILE! It costs nothing, and while you are smiling work like everything to make your property the best there is in the state. It won't be long before your subordinates, too, are beginning to take the same cheerful view of life, and the effect will be an increased efficiency in the individual and in the organization.—*Charles E. Morrison in Empire State Gas and Electric Association Bulletin.*

SEES ENCOURAGEMENT FOR LOWER OPERATING COSTS

President Alanson P. Lathrop of American Light & Traction Company Forecasts Probable Reduction in Abnormal Costs of Operating Expense

A statement to stockholders by Alanson P. Lathrop, president American Light & Traction Company, says in part:

The increase in gross income of the subsidiary companies for 1918, as compared with 1917, was $1,964,160, of which $430,367 was due to increased rates and $1,532,793 to increased business.

Cost of operation was materially increased over the abnormal costs of 1917 because of further advances in fuel, labor and taxes. Taxes for 1918 have been charged to operation on the basis of the federal tax bill, now before Congress. The increases in these items were: Coal and oil, $906,252; operating labor, $543,777; taxes—federal and local, $514,785; unclassified items, $222,719; total increased cost, $2,187,533.

Notwithstanding the large increase in costs over which the management had no control, the decrease in net profits on stocks of subsidiary companies accruing to your company is only $612,274, or approximately 28 per cent of the increased cost.

The increased costs of the three principal items for the two abnormal years 1917 and 1918 over the year 1916, which may be assumed to have been a normal year, are: Coal and oil, $1,890,952; operating labor, $855,077; taxes, federal and local, $1,219,785, making the total increased cost $3,965,814.

The encouragement derived from a study of these figures lies in their possible and probable reduction.

Coal should materially decrease; oil quotations already show large reductions. Labor will decrease some, and the federal tax bill now before Congress provides for a large decrease for the year 1919.

While in net results the report shows a decrease, an analysis of figures makes the report the most encouraging since conditions became abnormal.

TRANSITION TO PEACE FROM THE WAR BASIS

Forecast of Brooklyn Edison Company, Inc., Is that to a Large Extent This Will Be Accomplished in the Present Year

In the annual report to stockholders of the Brooklyn Edison Company, Inc., signed by N. F. Brady, president, and W. F. Wells as secretary to the board of directors, the following forecast based on existing conditions is made:

"The indications are that the present year will see to a large extent the transition throughout the country generally from a war to a peace basis. The company will, it is believed, be able to adjust itself to the changing conditions, and with the continuance of its established policy of economical management and a judicious campaign for new business, should be able to attain results that will prove acceptable."

Contracts signed in the last year, aggregating 52,000 hp., included installations for shipyards, the great army and navy bases at South Brooklyn, manufacture of torpedoes, ammunition, gyroscopes, stabilizers, searchlamps, gas-mask parts, shoes, uniforms, food products and various other war necessities. Twenty-two private plants were discontinued in favor of the company's service.

STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

FEATURES OF 13,200-VOLT UNDERGROUND CONSTRUCTION

Thickness of Manhole Wall Reduced to 8 in. of Concrete—Double-Pipe Ventilation Employed in New Construction by Kansas City Company

Several interesting features have been incorporated in a new underground system belonging to the Kansas City (Mo.) Light & Power Company. Concrete manhole walls 8 in. (20 cm.) thick are being tried out for this installation, ventilating pipes are carried up adjacent poles, and a novel protective coating of concrete is applied to cables within the manholes.

This system is to carry energy from its new 50,000-kw. power house on the Missouri River to its substations and transformer stations in several parts of the city. For economical distribution of material a duct arrangement of three ducts wide and four ducts high was selected.

MANHOLE CONSTRUCTION

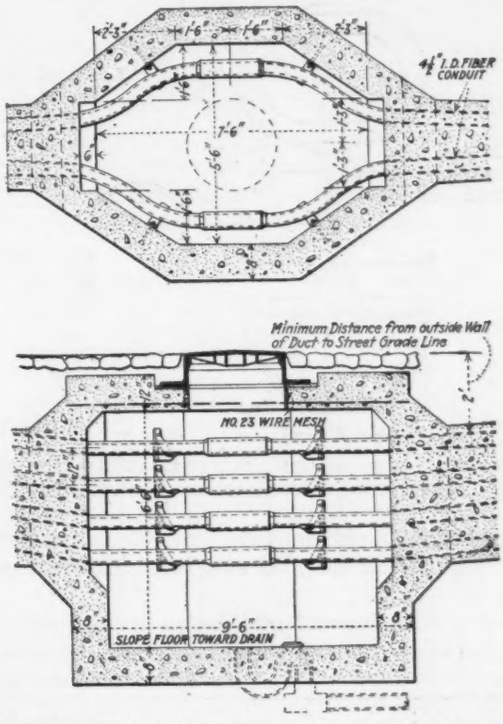
Concrete construction for manholes, some of which are below and some of which are above the high-water line of the river, was selected in preference to brick largely on account of the necessary labor entering into the construction. Engineers of the company believe it is possible to work concrete laborers at a much more satisfactory pace than brick laborers. One feature of these manholes, a cross-section of which is shown in the accompanying drawing, is that the walls and floor have been reduced in thickness from the customary 12 in. (30 cm.) to 8 in. (20 cm.). This reduction in thickness effected a considerable saving in material, and it is believed it will prove just as satisfactory as the thicker wall. The method of installing the manhole drain trap, with a hand-hole for cleaning in the bottom of the manhole, is considered very advantageous, as the hand-hole cover can be easily removed for draining the manhole after a flood if the drain basin has become clogged.

Provision against high temperatures in the manholes and against accumulation of gas is provided by a system of double-ventilation pipes. From each ventilated manhole two pipes, one coming from the top of the hole and one from the bottom of the hole, are carried up the nearest adjacent pole. The top of one pipe is also placed about 6 ft. (1.8 m.) higher than the other. This arrangement provides for circulation of air and eliminates any pocket effects. The 4.5-in. (11.4-cm.) pipes which are used for this purpose are fiber duct underground and iron pipe above ground. This selection of piping was chosen as the most inexpensive.

For making the joints between the sections of fiber conduit P. & B. cable paint was used instead of the customary tar. This joint was formed by painting the end sections of the duct, putting the sections together, then wrapping the joints with linen tape and painting over the tape. This type of joint is thought to be better than the tarred joint as the paint will not melt when subjected to high temperatures.

MECHANICAL PROTECTION OF CABLES

The 150,000 ft. (45,700 m.) of cable which is being laid is of the 400,000-circ.mil., three-conductor, 13,000-volt type and is insulated with mineral-base oiled paper. In the manhole it is supported on cast-iron brackets attached to the manhole walls by bolts cast in the cement as the manhole was constructed. All cables in the manhole are wound spirally with 0.25-in. (6.3-mm.) rope, free from oil or tar, on 0.75-in. (19-mm.) centers, after


4" I.D. FIBER CONDUIT
Minimum Distance from outside Wall of Duct to Street Grade Line
NO. 23 WIRE MESH
SLOPE FLOOR TOWARD DRAIN

STRAIGHT-LINE MANHOLE FOR USE ABOVE HIGH-WATER LINE

which they are covered with a one-to-one mixture of concrete, 0.75 in. (19 mm.) thick from end to end.

Cheesecloth is wrapped around the cable under the rope to facilitate removing this concrete covering if the occasion arises. A cheesecloth, concrete and rope type of covering was chosen in preference to others as it has been found to radiate heat readily from the cable. Where the cables leave the underground system to connect to the overhead lines single-unit terminals are employed.

This installation was made by the engineers of the Kansas City Light & Power Company under the direction of A. E. Gettis.

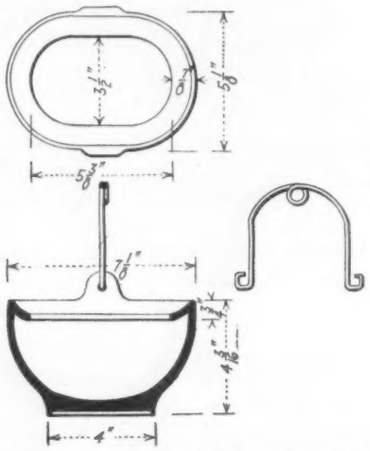
IMPROVED FORM OF POT FOR CONTAINING SOLDER

Space for Using Ladle and Safety Lip to Prevent Accidental Spilling or Loss of Cold Solder Are Desirable Features

BY L. V. SNYDER

The standard solder pot in general use when held by a lineman under a joint on the line does not allow sufficient space for the solder to fall back into the pot, and accidents are liable to occur from falling solder. Furthermore, when raising or lowering a standard solder pot on a pole there is a tendency for the solder to spill if the pot strikes a step or arm.

To avoid these objections, the Westchester Lighting Company, Mount Vernon, N. Y., adopted a specially designed solder pot of oval shape which has the advantage that there is space for the solder to fall back into the pot as well as for the lineman to use his ladle freely. If the pot did not have an oval shape, the safety lip would tend to obstruct the solder falling back into the pot and possibly make it spatter out. The safety lip on



OVAL-SHAPED SOLDER POT WITH SAFETY LIP INTO WHICH SOLDER CAN READILY FALL BUT FROM WHICH IT WILL NOT SPILL EASILY

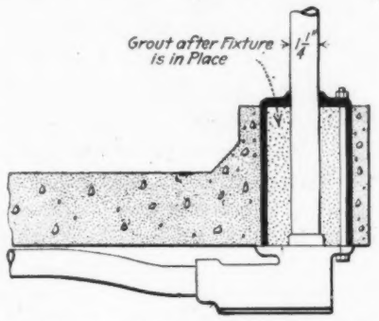
the inside of the pot prevents the solder from spilling out of the vessel when it is being raised or lowered on a pole.

Another advantage of this design is that the solder cannot be lost out of the pot as easily when it is cold because the lip projects inward enough to keep it from falling out.

SUPPORTING A BRACKET IN REINFORCED CONCRETE

Lower End of Gooseneck Threaded to Fit Condulet, Which Is Held by Metal Sleeve Grouted in Place

At the Boston army base a portion of the exterior lighting on one side of the storehouse is provided by 200-watt lamps mounted in reflectors carried at the ends of pipe brackets, as shown in the accompanying drawing. In order to provide a firm support for these brackets, which are 1¼ in. (32 mm.) in diameter and 3 ft. 6 in. (1 m.) high with a spread of 2 ft. (60 cm.), the pipe has been threaded into a special conduit fitting at the bottom of a cylindrical metal sleeve, the sleeve being filled with cement grout after the fixture is in place. Three bolts tie the condulet fitting into a cap on the top of the sleeve, and the whole construction is remarkably rigid and protects the wiring from moisture and mechanical disturbance. Total concealment is another advantage of this design. Fay, Spofford & Thorndike, Boston, were designing and supervising engineers for the terminal.



GOOSENECK LAMP BRACKET GROUTED IN LEDGE

RELATION OF LOAD FACTOR TO COAL CONSUMPTION

Averages of Data Collected by Ontario Commission from Seventy-three Stations and Arranged According to Plant Rating

Companies wishing to determine whether their plants are operating as economically as others of the same class may refer to the accompanying table for comparison. Of course, the values given for different-size plants do not necessarily apply to all plants of that size, because operating conditions may be different, but the values are typical of plants in this country and Canada, according to a report of the Hydro-Electric Power Commission of Ontario.

DATA ON LOAD FACTOR AND COAL CONSUMPTION FROM SEVENTY-THREE ONTARIO PLANTS

	Station Capacity	Maximum Load	Kw.-Hr. and Hp.-Hr. Generated	Kw.-Yr. and Hp.-Yr. Generated	Per Cent Load Factor	Lb. per Kw.-Hr. and Hp.-Hr.	Tons per Kw.-Yr. and Hp.-Yr.	Coal B.t.u. per Kw.-Hr. and Hp.-Hr.	Coal B.t.u. per Lb.	Consumption Tons per Year (2,000 Lb.)	Kw.-Hr. and Hp.-Hr. per 100,000 B.t.u.	Efficiency, per Cent
Kw.	650	425	1,123,820	128	29.3	7.65	34.60	95,600	12,500	3,930	1.04	3.5
Hp.	870	570	1,500,000	172	....	5.70	25.00	71,400	.....	.....	1.40	....
Kw.	2,980	1,570	4,703,600	538	34.2	4.30	19.00	55,500	12,900	9,230	1.80	6.2
Hp.	4,000	2,100	6,300,000	720	....	3.20	14.00	41,300	.....	.....	2.40	....
Kw.	7,230	3,820	10,422,000	1,190	31.7	4.07	17.80	48,500	11,900	20,200	2.06	7.0
Hp.	9,700	5,100	14,000,000	1,600	....	3.04	13.30	36,200	.....	.....	2.76	....
Kw.	24,600	10,760	33,500,000	3,829	36.0	2.90	12.75	39,600	13,600	48,030	2.50	8.6
Hp.	33,000	14,400	44,900,000	5,120	....	2.17	9.50	29,500	.....	.....	3.40	....
Kw.	96,000	62,060	200,679,750	23,650	36.9	2.00	8.80	28,000	14,000	201,420	3.57	12.1
Hp.	128,800	83,000	276,500,000	31,650	....	1.50	6.57	21,000	.....	.....	4.76	....
Kw.	149,000	92,080	360,218,000	41,000	44.7	1.92	8.40	25,900	13,500	345,580	3.86	13.1
Hp.	199,500	123,200	483,000,000	55,000	....	1.43	6.26	19,300	.....	.....	5.18	....

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

CENTRAL-STATION BUSINESS IS STEADILY PICKING UP

Reports from Minneapolis Show Better Gains in January than in the First Month of Previous Years

"From the standpoint of new business gained January was an exceptionally good month for Minneapolis compared with Januaries of past years," H. E. Young, sales manager of the Minneapolis General Electric Company, reports.

"The gain in electric meters was almost four times as much as in January, 1918. The gain in kilowatts of lighting load connected was three times, and twice as much power business was added, about 500 hp. in motors having been put on the lines. There were about 250 already-built houses wired for electricity during the month, and electrical appliances sold by the company show an increase of 32 per cent over January, 1918. Special attention to housewiring, commercial lighting and commercial window-display lighting should help to maintain brisk business in February."

CONSTRUCTIVE PLANNING FOR CENTRAL STATIONS

Problems to Be Met by Central Stations in Reconstruction Period Demand Closer Thinking than Did the War Emergency

D. L. Gaskill, secretary of the Ohio Electric Light Association, recently expressed the opinion that more brains will be required to work out the problems of central stations during the reconstruction period than was necessary to meet all of the problems caused by the entrance of the United States into the war. The war problem, he stated, was merely one of supplying an insistent demand, while the current problem is to get load to fill the valleys left by the cessation of war work. Some decision must be made as to what sort of business central stations will seek to fill these valleys. Electric heating is possibly one answer to this problem.

The acute labor situation has created a condition in which there has been no question of choosing labor for its quality. The problem has simply been to get enough labor in quantity. Now it will be the problem of the central-station executive to make a careful selection of his labor, and Mr. Gaskill expressed the opinion that the men who have returned from army service will be among the best material. Some of these men will want to go to work immediately, while others will wish to fit themselves for better positions. In order to aid the latter Mr. Gaskill stated that he had endeavored to set on foot a plan for providing a two years' university course in engineering.

One of the principal works of public utilities during this period, however, should be to capitalize the experience which they have had during the war period in molding public opinion in favor of the utilities. The taking over of the railroads by the government and similar action have shown the public generally that the burden of the war work has fallen heavily on utilities, and that in spite of this fact the utilities have served their communities in an admirable fashion. A spirit has been created in which the public is willing to deal more fairly with the utilities. That this should be analyzed and cultivated was Mr. Gaskill's belief.

POWER SALES AND PUBLIC POLICY POSSIBILITIES

Value of Frankness in Admitting Inability to Take Load at a Profit and in Seizing Good Publicity Situations

A public utility executive recently, addressing a meeting of power salesmen, declared it his belief that no business should be taken unless it showed a distinct profit for the company. The taking of other business will reflect on the company in many ways. His suggested method of dealing with isolated plants that were operating efficiently was that a very careful survey should be made to show the cost of operation. The survey should be prepared as a report and submitted with an estimate of the central-station service cost. If this survey shows that service cannot be taken efficiently, the report should be presented to the management of the isolated plant in just as great detail and with as much ceremony as if the business were expected. The only difference between this interview and the sales conference interview should be that at the end of the conference the power salesman should frankly inform the isolated-plant management that it could not economically buy service from the central station and that he was not soliciting the business but was merely presenting the facts in the case. The news of such treatment of the case will rapidly spread among other power-plant owners.

As illustrating a method of taking timely advantage of local situations, the speaker related a story from his earlier experience in Tennessee. When the shaft of a local flour mill suddenly broke, the speaker, who was then manager of the local transmission company, immediately offered his service in getting the mill started again. The management of the mill accepted the offer. It was 40 miles to the nearest motor that could pull the load, and this motor was then operating on construction work being handled by the transmission company in connection with one of its plants. Nevertheless, a truck was sent for the motor and instructions were tele-

phoned ahead to have it ready to load on the truck. The entry of the motor into the town was "staged" for the benefit of the citizens, the truck driving down through the main street with a crew four times as large as was needed cheering lustily. The motor was installed at the flour mill in record time. The whole story was given to the newspapers by the enthusiastic utility executive in such an able manner that it was made a front-page article. As advertising for the company's power service this incident outranked anything else that the company had attempted.

RAPID PROGRESS MADE IN LIGHTING SALES IN CHICAGO

Seeking Business in Already-Built Houses and Industrial Plants and Selling Signs Are Among Major Commercial Operations

Since the armistice was signed the contract department of the Commonwealth Edison Company, Chicago, has begun to drive ahead intensively on all lines of new business. During the war it was necessary to make a number of rules regarding new business in order to conserve the company's capital. One of the first steps now being taken in getting back to a peace footing involves the revoking or modification of these rules. This work is proceeding gradually, there being no wholesale reinstatement of the pre-war status. To each situation careful study is given before a change is made.

In the direct selling activities intensive work is well under way, as is indicated by the comparative sale results for January, 1918, and January, 1919. The lighting sales for the first month of this year are more than double those for January last year. The power sales show an increase of 50 per cent for the same period. Signs and industrial lighting are among the features of the lighting sales business. While only seventeen signs were sold in January, 1918, there were seventy-two signs sold in the first month of this year. Most of these were purchased by small stores in "neighborhood-business" districts.

The company's industrial lighting units which are put out on either a direct sales or a rental basis are finding exceptional favor. In January of 1919 1250 units were put out. The average intensity of all these installations was 6 foot-candles. The keeping of data on the foot-candle intensities of all installations is thought to be an innovation. The data are kept on each installation made at Chicago and are recapitulated for each month. In one of the fall months of 1918 the average intensity of all commercial installations sold reached the high figure of 6.7 foot-candles.

There is also a brisk demand for street lighting among neighborhood merchants' associations. No less than five meetings were attended by the contract department in the first week of February to discuss street lighting for business districts. Individual merchants are also displaying interest in better lighting for their stores. It is possible that a canvass of the "loop" district will add further to this class of load. Residential wiring in already-built houses and apartment buildings is progressing at such a satisfactory rate that more men have been added to the sales staff for this work, and the department is still behind as regards its inquiries.

ENERGY CONSUMPTION OF ELECTRIC RANGES

Some Interesting Figures Obtained as the Result of Specially Prepared Meal for Forty-five People

Some interesting figures showing energy consumption of an electric range for a specially cooked roast-beef dinner were obtained at the recent sales banquet of the Northwestern Electric Equipment Company of St. Paul. Fifty-five members of the sales and executive staff of the company were present.

The menu prepared for the banquet included soup, roast beef, three vegetables, bread and rolls, pudding and coffee. These foods were prepared with the following energy consumption:

	Watt-hours
Ten cans soup	469
18 lb. roast beef	2,325
1½ pecks potatoes and two cans peas	1,188
Five cans corn	300
Six loaves bread	1,000
Five dozen rolls	700
Fifty portions pudding	1,275
Seventy cups coffee	525
Total	7,782

The average consumption per person served was, therefore, 172.9 watt-hours. The entire cost for energy at the prevailing rate of 4 cents per kilowatt-hour was 31.128 cents, or 0.00691 cent per person.

The meal was prepared on a model "D" Hotpoint range, manufactured by the Edison Electric Appliance Company, by Miss Bernice Bell, domestic science expert of the Northern States Power Company.

MEN MUST BE TRAINED TO SELL ELECTRIC HEATING

Central Stations Declared to Lack Salesmen with Extensive Knowledge of Applications to Industrial Processes

J. C. Matthieu of the Dayton (Ohio) Power & Light Company recently declared that central stations in Ohio are negligent in looking into the prospects for electric heating loads. They lack the men to talk industrial applications of electricity for heating to the manufacturers in their territory. Each company should have, said Mr. Matthieu, at least one industrial heating sales engineer, just as they have a power sales engineer. Manufacturing plants in Ohio are at present being driven to the use of oil or producer gas for their heating processes because they cannot get the facts about electric heating.

Electrical manufacturers have men quite competent to handle this class of business, but it is physically impossible for them to stay with a prospective customer until he thinks over each deal. Such men can only interest the local manufacturer and then must turn the closing of the sale over to a local central-station man. Unless he is versed in the application of electric heating, he usually loses the business. It is Mr. Matthieu's opinion that it will be necessary for central stations to provide for education of industrial electric heating sales engineers, in order to avoid wholesale adoption of oil and gas processes.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Rebuilding 25,000-Kw. Generator.—THOMAS WILSON.—A number of years ago the Commonwealth Edison Company installed in its Fisk Street station a Parsons turbine driving a 25,000-kw. generator, but during recent months, when the power supply was being severely strained, the company noted the fact that the turbine had considerable margin of overload capacity, and it was then decided to reconstruct the generator to make this a 30,000-kw. machine. The process was carried out with the coöperation of the company engineers, the reconstruction being done by the manufacturer. One of the serious problems involved in this reconstruction work was the handling of the great weight and supporting the generator structure during the assembly of the laminations and rewinding process. It should be noted that the stator frame weight amounted to 138 tons. The change was accomplished without mishap.—*Power*, Jan. 21, 1919.

Lamps and Lighting

The Decrease in Ultra-Violet and Total Radiation with Usage of Quartz Mercury-Vapor Lamps.—W. W. COBLENTZ, M. B. LONG and H. KAHLER.—Comparative data are taken on the ultra-violet component in the radiations from the sun and from the quartz mercury-vapor lamps, using the thermopile and yellow glass for the measurements. In addition, data on the dye-fading carbon-arc lamp are given. It was found that the transmission of the yellow glass did not vary appreciably with the power put into the lamps, and any change in transmission of this glass with usage of the lamp was ascribable to variations in emission of ultra-violet rays caused by absorption passing the quartz glass tubes, which become discolored. It was established that ultra-violet rays emitted from quartz mercury-vapor lamps decrease from an initial value of about 70 per cent when the lamp is new to about 50 per cent after 1000 to 1500 hours' usage. It was observed that the total radiation from these lamps decreased in intensity by one-half to one-third the initial value in the course of 1000 to 1200 hours.—*No. 330, Scientific Papers of the Bureau of Standards.*

Progress in Illumination: An Abstract of the Report of the Committee on Progress, I. E. S.—The advances made in the field of illumination during this period are very thoroughly presented in the full report of the committee on progress of the Illuminating Engineering Society.—*General Electric Review*, January, 1919.

Light as an Aid to the Transportation of Material.—A. L. POWELL and R. E. HARRINGTON.—As a factor in our transportation and industrial problems the authors have demonstrated in a most convincing manner the importance of modern methods of illumination as applied to express and freight stations, warehouses, piers, etc. Time saved in the delivery of shipments must necessarily reduce transportation embargoes and indirectly increase our industrial output.—*General Electric Review*, January, 1919.

Generation, Transmission and Distribution

Cost of Electric Transmission.—H. E. M. KENSIT.—The author presents an interesting table giving the cost of electric transmission for various typical installations in the vicinity of Niagara Falls. The population of the distribution center, the distance of transmission and the amount of power delivered are specified for each case.— London *Electrical Times*, Jan. 2, 1919.

Original and Present Supply of Coal in United States.—A table prepared from estimates made by the Geological Survey of coal within 3000 ft. (900 m.) of the surface in the number of net tons of each grade and in each coal area is given. The total of all grades of coal in millions of tons is 3,553,637. In the last 111 years, since 1807, the mining has been conducted and the exhaustion has been about half of 1 per cent, but more than half of that has been in the last twelve years.—*Fuel Facts* (second edition), United States Fuel Administration, December, 1918.

Hydroelectric Power Development.—The potential water power of the United States, as estimated by the Geological Survey under conditions of minimum and maximum flow exclusive of the increase which should be brought about by the construction of reservoirs, is given in a table which shows the estimates arranged in geographical subdivisions of the country. Only one-sixth of the estimated minimum potential water power available in the United States is now being utilized. The advantage of electric over steam locomotives under certain conditions is mentioned, and two instances are pointed out.—*Fuel Facts* (second edition), United States Fuel Administration, December, 1918.

Arrangement of Power Conductors.—A short paper setting forth concrete recommendations for the spacing of power lines as made by the California committee on inductive interference. Technical mathematical calculations and six years of experimentation and study back the report.—*Journal of Electricity*, Jan. 15, 1919.

Meteorology and Stream Regulation.—W. F. V. ATKINSON.—The writer discusses the effect of weather and the protection of forest growth on the flow in streams. The study of wind, temperature, precipitation and barometer records aids in the control of schemes for power purposes.—*Canadian Engineer*, Jan. 2, 1919.

Water Powers of New Manitoba.—In this article is summarized a government investigation covering the study of four rivers of considerable capacity with a view to supplying energy for mining operations in the district named.—*Electrical News*, Jan. 15, 1919.

The Power Project at Hetch Hetchy.—RUDOLPH W. VAN NORDEN.—The Hetch Hetchy water and power project as planned by the city of San Francisco involves a development of power at Hetch Hetchy, another just above Early Intake and a third at Moccasin Creek. The one at Moccasin Creek, involving the development of 66,000 hp., will be carried out in the immediate future. Details of this project are given in this article.—*Journal of Electricity*, Jan. 15, 1919.

Experiences with an Electric Power Plant 11 Deg. from the North Pole.—JEROME LEE ALLEN.—It is of interest to learn that a complete electric generating plant has been installed and operated within a few hundred miles of the apex of the earth. This narration of experiences in connection with an Arctic electric plant is of particular interest on account of the geographical location of the plant and the prevailing severe climatic conditions.—*General Electric Review*, January, 1919.

Guying Pole Lines.—CHARLES R. HARTE.—The writer points out that practice in line guying has been standardized by the telephone, telegraph and power companies. Their experience is summarized as a guide on electric railway transmission-line construction. The problem is to keep the line safe without using unnecessary material in guys and anchors.—*Electric Railway Journal*, Jan. 18, 1919.

Combustion and Boiler Settings.—A. D. WILLIAMS.—In the first article of a series the author mentions a number of interesting points concerning the location of heating surfaces and the placing of baffles. He discusses soot formation in relation to combustion and indicates certain fundamentally wrong practices in the usual forms of boiler settings.—*Power*, Jan. 14, 1919.

Boiler Equipment.—MARTIN O'CONNOR.—The author discusses proper provision for boiler feeding, blowing down and insurance of safe operation.—*Power Plant Engineering*, Jan. 1, 1919.

Economizer Practice.—RAINES KESSLER.—In this paper are discussed the possible savings that may be expected from the use of the economizer and also its care and operation.—*Power Plant Engineering*, Jan. 1, 1919.

Economizers.—OSBORNE MONNETT.—The ranges of water and gas temperatures in economizer practice are discussed, as well as the influence of other equipment of the plant, draft requirements and inspection.—*Power Plant Engineering*, Jan. 1, 1919.

Traction

Regenerative Braking with Single-Phase Commutator Motors.—DR. H. BEHN-ESCHENBURG.—In this article is given a description of a system of regenerative braking in which the wiring and switching operations are simplified and the range within which regeneration is practical is greatly extended, according to the writer.—London *Electrician*, Dec. 20, 1918.

Automatic Substations on the North Shore Line.—CHARLES H. JONES.—Three new substations recently installed by the company and a fourth under construction are said to save 177 miles of 500,000-circ.mil cable worth $650,000. Feeder economics are discussed in this paper and details of a typical substation layout are given.—*Electric Railway Journal*, Jan. 11, 1919.

The Cam-Operated Railway Controller.—R. S. BEERS.—An early description of the cam-operated railway controller appeared in the October, 1915, *General Electric Review*. Since then this type of controller has been put in service under all the various conditions of electric car operation. This article presents the confirming evidence that the cam-operated controller has fulfilled in a most satisfactory manner the expectations of the engineers responsible for its design, and describes the salient features of its operation.—*General Electric Review*, January, 1919.

Installations, Systems and Appliances

Pumping Plant and Electrical Equipment at Balboa Shops.—R. D. GATEWOOD.—A brief description of the power plant and pumping equipment in use at the Balboa shops in the Canal Zone. It is said that this layout has proved to be particularly dependable.—*Power*, Jan. 28, 1919.

Electric Smelting on the Pacific Coast.—W. L. MORRISON.—The high prices of the war developed the smelting industry in the West and created an opening for the use of the electric furnace. The absence of cheap power precludes a general development along this line in normal times. There is a real opportunity in the smelting of silicon manganese as pointed out in a paper recently given before the Portland sections of the A. I. E. E. and N. E. L. A.—*Journal of Electricity*, Jan. 15, 1919.

Application of the Electric Furnace to the Metallurgy of Iron and Its Alloys.—H. ETCHELLS.—A comparison is made between the results attained with electric (arc resistance and induction type) and combustion furnaces.—London *Electrician*, Dec. 27, 1918.

Notes on Regulations for Arc Welding.—Regulations to secure the safety of operators using electric welding apparatus are under consideration by the British government. The subject is treated in two parts, namely (1) the protection of operators and workers in the vicinity and (2) proposed regulations affecting the reliability and control of supply systems.—London *Electrician*, Dec. 20, 1918.

Electricity Supply in Sheffield.—A historical sketch of the development of the generating plant in this important manufacturing district of Great Britain.—London *Electrical Review*, Jan. 3, 1919.

Equipment Accessories in Electric Arc Welding.—The paper is abstracted from the 1918 report of a committee of the Association of Railway Electrical Engineers, which points out proper protection for operators and shows that such arrangements insure better workmanship.—*Electric Railway Journal*, Jan. 11, 1919.

Machine-Tool Drives; Motors and Controllers.—H. W. TICE.—The writer gives a useful table of motor failures in a certain machine shop and points out conclusions to be drawn in selecting and arranging the apparatus.—*Journal Engineers' Club of Philadelphia*, February, 1919.

Electric Welding in Navy Yards.—LIEUT.-COMMANDER H. G. KNOX.—In the introduction of this article the author first outlines the are-welding and resistance-welding processes as related to their general application in navy yards. Following this preliminary treatment, he considers the work conducted in each type of

shop in a navy yard, recommends the kinds of welding equipment desirable in each shop, and illustrates by many photographs the character and variety of the work done. In conclusion, he gives figures on the speed and cost of welding ship structures and cites from steam railroad records comparative cost data of welding and other methods.—*General Electric Review*, December, 1918.

Recent Developments in Machines for Electric Spot Welding as a Substitute of Riveting.—J. M. WEED.—The author's description of recent developments in machines for electric spot welding are very comprehensive. Evidently electric welders can be designed for use in all trades wherein metal is joined, with results superior to present methods. The author's experiments have demonstrated that the previously supposed natural limits of the process as to the thickness of the parts to be welded are governed only by the capacity of the apparatus available for doing the work.—*General Electric Review*, December, 1918.

Spot Welding and Some of Its Applications to Ship Construction.—H. A. WINNE.—Starting with the early practice of spot-welding light-weight construction, Mr. Winne describes the extension of this type of welding to heavy work, notably the fabrication of the parts used in the construction of ship hulls. He discusses the advantages of spot welding over riveting with respect to strength, time and labor and outlines the limitations of the spot welder. In conclusion, he describes in detail the application of spot welding to the construction of ladders and gratings and to the plugging of misplaced holes.—*General Electric Review*, December, 1918.

Electrochemistry and Batteries

Power Factor of Electric Arc Furnaces.—As a result of theoretical and experimental study, the author has arrived at these conclusions: (1) The power factor of electric arc furnaces depends not alone on the inductive action of the circuits but also, and in general chiefly, on the physical and chemical phenomena which take place in the oven. It follows that in the same oven with the same arrangement of the circuits power factor may vary greatly. (2) In properly constructed arc furnaces, where the electrodes are constant in section and the applied potential is also constant, the power factor increases with the effective intensity of the current. (3) Where the electrodes are constant in section and the effective intensity of the current is also constant the latter diminishes as the effective value of the applied potential grows. (4) With constancy of current and of applied potential the power factor varies with variations in the section of the electrodes and increases with greater density of current. (5) With constant applied potential and current density the power factor increases with increase in the section of the mobile electrode; that is to say, with the growth of the power used in the furnace. (6) With constancy of applied potential the variation of the power factor relative to a given variation of the density of the current is, within large limits, greater as the diameter of the electrodes is greater. (7) The power factor of the oven, all the other conditions being constant, will diminish greatly when an open arc is substituted for a closed arc. (8) Regular performance of the oven as concerns stability of the arcs will correspond to high power factor. (9) With high power factor there is an absence of loud irregular noise from the arc, which will instead emit a characteristic heavy note, corresponding, it may be, to the frequency of the current. (10) The power factor of arc furnaces depends also upon the values of the differences of potential which result from its application to the extremities of the interior resistances of the oven (electrodes and bath) and to the extremity of the true arc. Other conditions being equal, when the first differences of potential increase as compared with the second the power factor is better. (11) The power factor of arc furnaces depends in many cases on the nature of the load, of the bath and of the chemical reactions which are produced in the crucible. Other things the same, it increases as the ionizing power of the charge and of the bath augments, and it may have values especially high when chemical reactions of a special nature have just taken place in the crucible.—*L'Industrie Electrique*, Dec. 25, 1918. *(Abstracted from Rivista Tecnica d'Elettricita.)*

Miscellaneous

Some Developments in the Electrical Industry During 1918.—JOHN LISTON.—A résumé of the developments in electrical machinery, and particularly in the line of industrial heating and welding appliances and lighting equipment.—*General Electric Review*, January, 1919.

Salvaging Industrial Wastes.—W. ROCKWOOD CONOVER.—A beneficial result of the war, and one which ought to be lasting, was the great effort on the part of industry to eliminate waste. The government campaign for conservation of materials showed the manufacturers what could be accomplished, and they were enthusiastic to put these economies in force. The salvaging of industrial wastes is a big factor in the economy of materials, and in this article Mr. Conover briefly outlines what saving can be accomplished by reclaiming scrap materials.—*General Electric Review*, January, 1919.

Coal Handling at Ports.—H. HUBERT.—A description and illustrations are given of a number of modern plants for handling coal at ports by means of large electric cranes and coal transporters. The specifications for these cranes are given, together with an idea of the amount of coal that can be handled in this manner.—London *Electrician*, Jan. 10, 1919.

Phase Displacement and Its Relation to Methods of Charging for Power.—H. BUSSMAN.—The paper, which is abstracted from one printed in the *Elektrotechnische Zeitschrift* No. 10, 1918, considers a hypothetical case in which two stations operate in parallel with one station underloaded and the other overloaded. The trouble arising from improper excitation is discussed, together with a notation of the several methods used for overcoming the phase displacements. The method recommended for eliminating the low-power-factor condition is to make the consumer liable for reductions in efficiency in using an inductive load. New developments on power-factor meters can be advantageously used in determining the exact liability of the consumer. By means of the sine meter it is possible to supervise two stations working in parallel and to provide for the proper excitation of each.—London *Electrician*, Jan. 17, 1919.

Readers' Views and Comments

Power Factor and Power Rates

To the Editor of ELECTRICAL WORLD:

Sir: Power factor and coal costs have long been with us, but it took the war to emphasize the fact that there is a decidedly definite relation between variations of these quantities and electricity rates. The discussions by Will Brown relative to the first-named quantity and the editorial comment thereon published in recent issues of the ELECTRICAL WORLD have interested me very much.

That it is more costly to serve a low power-factor load than one requiring an equal amount of energy at unity power factor we can, I believe, all agree. But, desirable though it may be from the central-station viewpoint to insert power-factor or other modifying clauses in power contracts, we must, at least so far as the small consumer is concerned, not forget to look at the problem from the consumer's viewpoint. The cost-of-service theory is a beautiful one in many respects, but like many another beautiful thing it has its limitations, as any one who has ever juggled with rates knows only too well. Rates based thereon easily become complicated, and complications bewilder the consumer. Confronted by such things as load factor, power factor, diversity factor, maximum demand, integrated maximum demand, lagged maximum demand and all of the other numerous but honorable members of the demand and other families, the poor lay consumer is likely to become hopelessly befuddled. If he operates a 5-hp. motor and is asked to pay a bill one part of which comes from a demand-charge rate scale, another from an energy-consumption scale, another from a coal-price scale and still another from a power-factor scale, he begins to wonder whether he is really paying for electric service or the salaries of an office force which he did not employ.

The experience of some at least of our public utility commissions is that rates are already too complicated and that any changes made should be toward simplification rather than complication.

The above is written, not with the thought of disparaging the importance of power factor or any other controlling element in rate making, but to emphasize the need of simplicity in the rates for a given class of consumers even if such simplicity is gained at the expense of certain individuals of the class. Assuredly all the elements of cost should enter the rate, but the scale finally evolved should be simple. Of course, for the very large consumer who maintains a technical staff of his own complications in rate schedules are not of serious moment and the insertion of power-factor or other special limiting or modifying clauses in the power contract may be highly desirable.

As Mr. Brown points out, the metering problem presents difficulties when it comes to enforcing power-factor clauses. We need to know not only what might be termed the "load-factor effect" of low power factor but also something which gives us a clew to the distribution losses caused by the long-time operation of low-power-factor loads. These losses form a not negligible portion of the 15 to 40 per cent of generated energy which is never recorded on the customers' meters. The graphic recording power-factor meter has about the same relation to the desired meter as the graphic recording wattmeter has to the watt-hour meter. The development of a suitable meter would greatly simplify the problem.

It has been for some time an open question in my mind as to whether a reactive-power clause is not better than a power-factor clause. Space limitations forbid an extended discussion of the matter here, but it may be pointed out that such a clause has marked advantages from the standpoint of metering. We have so long focused our attention on the power component of volt-ampere-hours that the significance of the reactive component has escaped our attention. The reactive volt-ampere-hours input to a polyphase circuit may be simply and directly measured with existing metering equipment. For single-phase circuits a reactive volt-ampere-hour meter would have to be developed, possibly, but the difficulties in the way of such development appear far less serious than those attendant on the development of a straight volt-ampere-hour meter as suggested in Mr. Brown's article, or of any form of integrating power-factor meter. Further, it seems to me that the reactive ampere-hour-meter readings would possess much the same psychological advantages that the modern reactive-factor indicator possesses over the power-factor indicator in connection with the operation of synchronous motors and converters.

D. D. EWING.
Purdue University, Lafayette, Ind.

Bell-Alarm Protection

To the Editor of ELECTRICAL WORLD:

Sir: In a letter to the editor published in the ELECTRICAL WORLD of Dec. 21, 1918, E. H. Beckert of the switchboard department of the General Electric Company takes issue with certain recommendations made in our article on "Safety Features in Switching Installations" which was published in the ELECTRICAL WORLD of Nov. 9, 1918.

Bell Alarm on Hand-Operated Circuit Breakers. — The scheme suggested by Mr. Beckert is well known. It consists of an attachment directly on the circuit breakers. Such circuit breakers are generally mounted high up near the top of a switchboard, and the operator when resetting them will often accidentally touch energized parts. It is for this reason that operators often seriously object to this arrangement. The system suggested by us makes the resetting device more accessible, in our opinion.

Electrically Operated Circuit Breakers.—Mr. Beckert also suggests that an additional contact be installed on the overload relay for the purpose of bell-alarm operation. If Mr. Beckert had consulted the relay department of the company for which he signs, we believe he would not have recommended this change because the relay department does not favor the addition of any contacts on relays. On induction relays it is practically impossible to install additional contacts; even on bellows relays they are not recommended. An alternative to the scheme suggested by us would be to install two additional auxiliary relays in each circuit, which, of course, would be much more complicated and expensive than our scheme.

Mr. Beckert's statement that the two schemes described by him seem to be better and less expensive than those suggested by the authors must therefore be considered as not in keeping with the recommendations of his own company.

M. M. SAMUELS,
New York. F. BECHOFF.

Balance Protection of Cable Systems

To the Editor of ELECTRICAL WORLD:

Sir: In your issue for June 29, 1918 (Vol. 71), there is a description of the "Balance Protection of Cable Systems," in which not only the balance protective device is mentioned but also the split-conductor system.

I notice that in this article no reference is made to the men responsible for the introduction of these protective devices, which have been acknowledged to be the best system and the only one capable of protecting large interconnected cable work, generators and transformers. It would appear from your article that the idea emanated from Mr. Cole, whereas the patents are held by Messrs. Merz and McLellan in the name of the Merz-Price system and the Merz-Hunter split-conductor system. It is by these names that we know them in England, and I think that, in virtue of what has been done by them, it should be pointed out that it is to their genius that we owe to-day the means of protecting large interconnected systems.

If you will refer to the *Proceedings* of the American Institute of Electrical Engineers, Vol. 36, No. 2, February, 1917, page 282, you will find that had the system of protection with the Merz-Price or Merz-Hunter apparatus been used, an 80,000-kw. station would not have been isolated, which should be the best testimonial that can be given.

WILLIAM T. TAYLOR,
Electrical Superintendent Western Australian Government Electricity Supply, East Perth, Australia.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

N. E. L. A. WILL MEET AT ATLANTIC CITY IN MAY

Next Annual Convention to Be Held During Week of May 19—Announcement of the Exhibition Committee Plans and Activities

The exhibition committee of the National Electric Light Association held a meeting at the headquarters, New York, on Feb. 15, under the chairmanship of J. W. Perry. It was formally decided to approve the proposition to hold the next annual convention at Atlantic City during the week of May 19 and to resume all the proposed plans and activities that had been so carefully worked out in 1917, with additional features of interest to the operating member companies. These will be given in full for publication as soon as possible.

In the meantime the committee desires to announce to the Class D exhibiting members that all reservations made in 1917 as to exhibition space will be given priority and be carried out by the exhibition committee, which is communicating immediately with all the pledged and prospective exhibitors, upon whom it is impressing the fact that this is the reconstruction convention after the great war, the most notable and historic in the life of the N. E. L. A.

H. G. McConnaughy, secretary of the exhibition committee, can be addressed on all such matters at the association offices, and it is suggested that all exhibitors get in touch with him at once.

ANNUAL MEETING OF THE ASSOCIATED MANUFACTURERS

Fourth Annual Gathering to Be in New York on March 20 —Schedule of Committee and Section Meetings to Precede Association Convention

The fourth annual meeting of the Associated Manufacturers of Electrical Supplies will be held at Delmonico's, New York, on March 20. The business sessions will be at 10:30 a.m. and 2:30 p.m. In the evening of the same day the fourth annual banquet will be held in Delmonico's. This will be a social event, with entertaining speakers, music, etc., to which members may invite guests, table reservations being made for those desiring to sit together.

It is desired that there be a full attendance at both the annual meeting and banquet. Charles E. Dustin, the general secretary, notifies members that much of interest will be presented covering the work and progress of the association.

Following is a schedule of the section and committee meetings to be held during the week of the meeting of the Associated Manufacturers of Electrical Supplies:

Monday, March 17, 1919.—Industrial and Street-Lighting Fixture Section, 10 a.m.; Signaling Apparatus Section, 2 p.m.

Tuesday, March 18, 1919.—Air-Circuit-Breaker Section, 10 a.m.; Heating-Appliance Section, 10 a.m.; Snap-Switch Section, 10 a.m.; Molded or Formed Insulation Section, 10 a.m.; Lamp Receptacle and Socket Section, 2 p.m.; Line-Material Section, 2 p.m.; Outlet-Box Section, 2 p.m.; Attachment-Plug Section, 4 p.m.

Wednesday, March 19, 1919.—Fan-Motor Section, 10 a.m.; Fuse Section, 10 a.m.; Panelboard and Switchboard Section, 10 a.m.; Rigid-Conduit Section, 10 a.m.; Electrical Porcelain Section, 11:30 a.m.; Non-Metallic Conduit Section, 2 p.m.; Insulating Materials Section, 2 p.m.; Knife-Switch Section, 3 p.m.; Armored Conductor and Metallic Flexible Conduit, 4 p.m.

PRODUCTION CONDITIONS AT PITTSFIELD DISCUSSED

Manager of General Electric Company's Plant Tells of Unfilled Orders and Cancellations—How Product Is Divided

Interesting sidelights upon production conditions at the Pittsfield (Mass.) works of the General Electric Company were brought out at a recent public hearing before the State Board of Conciliation and Arbitration by C. C. Chesney, general manager of the plant. Mr. Chesney said that the number of employees at Pittsfield about the middle of January was 6683, compared with 5777 in the week before Christmas. The unfilled orders at these works on Jan. 1, 1918, totaled $10,500,000, and on Dec. 1, 1918, they totaled $6,500,000. Up to the middle of January the unfilled orders were reduced by about $1,000,000 more, due to cancellations, chiefly of government orders. The total reduction of unfilled orders in the year from Jan. 1, 1918, to about Jan. 15 last was therefore $5,000,000, representing the labor of 2000 men for six months.

The contracts canceled since the armistice was signed included gas shells and searchlight controllers. Mr. Chesney said that the Pittsfield works manufacture transformers up to 10,000-kw. rating and motors up to 25-hp. rating. Stocks had been increased during the year above noted by about $1,500,000. Transformers represent about 50 per cent of the total business done by the plant. On Jan. 15 the factory was filling orders for the following material or equipment at the named percentages of the capacity for such apparatus: Large transformers, 10 per cent; small transformers, 16 per cent (capacity 1500 a week); regulators, 6 per cent; lightning arresters, 25 per cent; motor work, 60 per cent; foundry, 50 per cent.

OUTLOOK FOR INDIANA ELECTRIC PROPERTIES

On Basis of Mining Cost There Is Little Possibility of Much Decrease in Price of Coal for Central-Station Consumption

BY ALEX. R. HOLLIDAY

An industry will develop and prosper only when the reward attracts capital and brains. Under present conditions the Indiana electric properties offer no such reward. The net income to these properties must increase unless the industry and the people served are to suffer.

This increase in net may be accomplished through decreased expenses or through increased revenues per kilowatt-hour. Expenses may be decreased by operating economies or by paying less for labor and materials. Operating economies have been closely studied during the past two and a half years of high costs and offer in most plants little further in possible saving. The skilled labor market shows no indication of decreasing in price. Of the materials constituting the cost per kilowatt-hour coal is by far the largest.

Prior to April 1, 1916, Indiana screenings sold fo.b. mine at 75 cents per ton. An average freight rate at that time was 75 cents, making a total cost at plant of $1.50 per ton. The recent government price at mine was $2.05. The freight above quoted plus war tax is now $1.33, making a total cost at plant of $3.38, an increase of $1.88, or 125 per cent, in three years.

How much can the price of coal be reduced and still leave a profit? Roughly, the mining costs per ton of a thousand-ton-per-day Indiana mine are as follows (Federal Trade Commission classification of accounts is used):

LABOR	
Mining	$0.75
Yardage and dead work	.15
Haulage	.25
Tipple	.05
Power	.03
Other labor	.15
Maintenance structures	.02
Maintenance equipment	.03
Supervision and engineering	.08
Total	$1.51
SUPPLIES	
Mine timber	$0.05
Feed and stable supplies	.02
Power house fuel	.05
Power purchased	.01
Other supplies	.04
Maintenance and repair structures	.01
Maintenance and repair equipment	.04
Total	$0.22
FIXED CHARGES	
Royalty	
Depletion	$0.02
Depreciation structures	.06
Depreciation equipment	.07
Taxes	.01
Insurance	.04
Officers' salaries	.01
Clerical and office expenses	.02
Miscellaneous expenses	.01
Total	$0.24
SUMMARY	
Labor	$1.51
Supplies	.22
Fixed charges	.24
Total	$1.97

to which are to be added selling expense, bad debts, etc.

The total figure is correct for approximately a hundred mines, running nearly full time, although the division of the total in the various accounts differs. Less than full time running will increase the per ton of all items except the first labor charge.

On a basis of producing 40 per cent screenings and 60 per cent lump, selling both at the recent government price of $2.05 and $2.55 respectively, the average price per ton is $2.35. If, therefore, all profit, selling expense and bad debts are eliminated, an average of 38 per cent per ton may be deducted. Screenings under this competition and supposing they bore the per ton mining cost would sell for $1.67, or 18 per cent less than at present. When this point is reached the smaller and the high-cost mines will soon be eliminated, the thousand-ton mines will break even or lose a little, and the larger mines will make a profit. Three-quarters of the expense is labor. This labor receives a high wage per ton or per hour. The minimum day wage is $5. But with the present market this labor gets only two or three days' work a week, which brings the return to the miner to quite a modest figure. The miner is more apt to demand an increase in wage than to accept a cut under present mining conditions. Obviously there should be fewer coal miners and fewer mines to reduce cost materially. That situation may come about through economic pressure, but years may be required. It is with the immediate situation we are dealing.

There is not the slightest indication that the freight rates under federal or private control of railroads can be reduced. So we have the possibility, under keen market competition, that the average plant price of coal may be reduced from $3.38 to $3.01, or 11 per cent. In the total generating cost this amount is virtually nil.

The one remaining solution of the electric utility problem is increased selling price. The Indiana Public Service Commission has granted so-called "temporary surcharges" sufficient to keep the companies from bankruptcy but not sufficient to keep them in a healthy financial condition. Not only these surcharges must be made permanent, but other raises approved, if our electric utilities are to prosper, if they are to attract capital and brains, and if they are to continue to perform their function in the life of the state.

STATUS OF TELEPHONE CASE IN MASSACHUSETTS

Full Bench of Massachusetts Supreme Court Will Hear Arguments on Appeal from Postmaster-General's Toll Rates

The full bench of the Massachusetts Supreme Court will hear arguments relative to the jurisdiction of the Public Service Commission in the Postmaster-General's telephone toll-rate case probably during the last week of the present month. The case was called up before Judge De Courcy at Boston and was referred to the full bench. The Attorney-General of Massachusetts will urge the full bench to grant an injunction against the New England Telephone & Telegraph Company in order that the former intrastate toll rates may be put back into service. United States District Attorney Boynton will probably be present on behalf of the Postmaster-General, and President Matt B. Jones will appear for the New England company.

DAMAGE TO HYDROELECTRIC PLANT AT CLINTON, MASS.

Metropolitan Water and Sewerage Plant Flooded by Water Through Broken Wheel Casing—Estimated Damage Is About $5,000

The hydroelectric plant of the Metropolitan Water and Sewerage Board at Clinton, Mass., was flooded by water from a broken wheel casing Monday morning and damaged to the extent of $5,000. The station contains four 1000-kva. Westinghouse three-phase, 13,800-volt alternators, each directly connected on a horizontal shaft to a 1200-hp. S. Morgan Smith hydraulic turbine, and two independently driven exciter generators rated at 60 kw. each. The plant was installed in the summer of 1911, and the wheels are operated under available heads ranging from 80 ft. to 100 ft. (24 m. to 30 m.), depending upon the elevation of water in the reservoir and the quantity flowing in the aqueduct. The station is at the base of the Clinton dam, which impounds water stored for the domestic and industrial supply of metropolitan Boston, and the energy developed is mainly sold to the New England Power Company.

The water supplying each of the wheels flows from the reservoir into a masonry chamber built in the dam, which is provided with screens, stop-planks and sluice valves; thence through a vertical well 7 ft. (2.1 m.) in diameter extending to a depth of 111 ft. (33.8 m.) below high water in the reservoir; thence through a 48-in. (121-cm.) cast-iron pipe extending horizontally 114 ft. (34.7 m.) through the dam into the power house. There are besides connections with the Wachusett aqueduct and with waste pipes for conveying the water to the Nashua River below the dam. The wheels and generators are supported on a foundation of heavy concrete masonry, forming wells into some of which the draft tubes discharge, while others contain valves controlling the flow of water. In each penstock directly under the turbine there is placed a 48-in. (121-cm.) Pratt & Cady valve operated by water pressure by means of a 24-in. (60-cm.) diameter hydraulic piston. The upper gates controlling the admission of water to the penstock are ordinarily electrically operated.

A crack which developed in the wheel casing about a year ago in the unit which failed had been repaired, and the fracture Monday morning occurred on the opposite side of the casing. At the time of the accident the supply of energy gave out before it was possible to close the gate valves electrically or to close the hydraulic valve under the affected unit. The gates were closed by hand in about thirty minutes. Meanwhile the water flooded the operating room, submerging generating units and switchboard and finally breaking open a doorway and flowing into the river bed. The interior furnishings were considerably tossed about, but the operators succeeded in shutting down the injured units before the water reached them, thus preventing short-circuit or grounding damage.

Census Bureau Report of Electric Light and Power Stations—1917

Preliminary figures, published herewith, of the forthcoming quinquennial report on the central electric light and power stations of several states have been given out by Director S. L. Rogers of the Bureau of the Census, Department of Commerce. They were prepared under the supervision of Eugene F. Hartley.

The statistics cover both commercial and municipal plants. They do not cover electrical plants operated by factories, hotels, etc., which generate for their own consumption, those operated by the federal government and state institutions, and those that were idle or in course of construction.

	New Jersey			Florida			Oregon		
	1917	1912	Per Cent of Increase * 1912 to 1917	1917	1912	Per Cent of Increase 1912 to 1917	1917	1912	Per Cent of Increase * 1912 to 1917
Number of establishments	63	64	—1.6	82	50	64.0	68	66	3.0
Commercial	47	56	—16.1	50	33	51.5	53	54	—1.9
Municipal	16	8	100.0	32	17	88.2	15	12	25.0
Income	†$23,480,320	†$10,944,367	114.5	‡$2,376,908	‡$1,361,201	74.6	¶$2,577,297	¶$1,422,703	81.2
Electric service	$20,188,244	$10,587,513	90.7	$2,334,876	$1,338,781	74.4	$2,454,047	$1,380,785	77.7
All other	$3,292,076	$356,854	822.5	$42,032	$22,420	87.5	$123,250	$41,918	194.0
Total expenses, including salaries and wages	$18,760,138	$9,348,864	100.7	$1,684,569	$1,052,696	60.0	$2,276,169	$1,205,738	88.8
Number of persons employed	5,065	2,989	69.5	678	455	49.0	636	§532	19.5
Salaries and wages	$4,821,852	$2,479,219	94.5	$471,035	$286,053	64.7	$583,195	$387,119	50.6
Total horsepower	367,743	239,514	53.5	58,195	33,836	72.0	68,706	46,015	49.3
Steam engines:									
Number	188	251	—25.1	140	90	55.6	46	54	—14.8
Horsepower	353,021	235,585	49.8	50,477	27,606	82.6	27,062	15,879	70.4
Internal-combustion engines:									
Number	24	21	14.3	24	6	300.0	15	9	66.7
Horsepower	12,665	2,360	436.7	2,008	500	301.6	578	334	73.1
Waterwheels:									
Number	15	18	—16.7	5	3	66.7	80	60	33.3
Horsepower	2,057	1,569	31.1	5,710	5,700	0.2	41,066	29,802	37.8
Kilowatt capacity of dynamos	249,521	179,477	39.0	37,812	23,619	60.1	47,917	32,416	47.8
Output of stations, kilowatt-hours	781,230,790	383,891,504	103.5	50,887,992	25,895,751	96.5	107,886,973	58,789,342	83.5
Stationary motors served:									
Number	30,679	12,772	140.2	2,097	1,121	87.1	3,284	1,527	115.1
Horsepower	262,858	85,011	209.2	22,235	14,141	57.2	31,682	15,843	100.0
Number of street lamps:									
Arc	13,580	16,052	—15.4	1,249	1,213	3.0	489	1,128	—56.6
Incandescent, etc	53,652	33,708	59.2	12,621	4,752	165.6	10,363	6,239	66.1

* A minus sign (—) denotes decrease.
† Exclusive of $42,313 in 1917 and $116,829 in 1912 reported by street and electric railway companies as income from sale of electric energy.
‡ Exclusive of $749,113 in 1917 and $561,416 in 1912, reported by street and electric railway companies as income from sale of electric energy.
¶ Exclusive of $2,047,853 in 1917 and $2,327,822 in 1912, reported by street and electric railway companies as income from sale of electric energy.
§ Includes approximately 100 part-time employees.

AWARD OF SERVICE MEDAL TO GEN. GUY E. TRIPP

Distinguished-Service Medal for Chairman of the Board of Westinghouse Electric & Manufacturing Company for War Service

By direction of President Wilson, Secretary of War Baker has announced that the distinguished-service medal has been awarded to Gen. Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company. The citation as published in army orders follows:

"Guy E. Tripp, as chief of the production division of the Ordnance Department, and later as assistant chief of ordnance, displayed fine technical ability and broad judgment in systematizing methods and practices resulting in the efficient coöperation of industries producing articles of ordnance for the army."

INTERIM REPORT OF THE PUBLIC POLICY COMMITTEE

Committee of the N. E. L. A. Says that Members Will Now Be as Willing to Co-operate in Reconstruction as They Were Eager to Support the War

After consideration and discussion of the conditions arising from the ending of the war, the public policy committee of the National Electric Light Association has submitted an interim report of comments and recommendations.

The committee recalls the resolution passed at the Atlantic City convention last June in which the association pledged "all that we have and all that we are" to the winning of the war, and through such success, "the winning of a great peace."

"The members of the association may take just pride in the active and unqualified support which has been given to our government by the industry in the form of money, men and utility service, which have contributed in some measure to the glorious results that have been achieved," says the committee. The report adds:

"The members of the association will now be as willing to take hold of reconstruction problems and coöperate heartily and effectively in their solution as they were eager to support the war program, and it is not too soon to formulate policies to meet the conditions of the near future."

Planning future activities, the judgment of the committee is that all association committee work should be resumed promptly and restored to the full measure of activities as soon as possible; also that the 1919 convention should be along pre-war lines as nearly as practicable under present conditions.

Regarding reëmployment of soldiers the judgment and recommendation of the committee is:

> Resolved, That we commend the action of the large number of corporations which gave to their employees who entered the military service in the present war the definite promise that they would be restored to their former employment at the conclusion of that service, and we strongly recommend to all our member companies that, as far as practicable, they adopt the same practice.
>
> Employees who gave up their positions to serve in the army or navy or other governmental war service deserve well of their country, and it is but a just recognition of their patriotism to insure them against the loss of the means of livelihood which they could have continued to enjoy except for their disinterested and patriotic action in entering the military service of the country in its time of need.

On the subject of public ownership of utilities it is stated that public opinion will be divided as to the influence of war experiences upon the question.

"The former advocates of public ownership," says the report, "will try to see in the extension of public control exercised during the war a trend which is likely to continue. On the other hand, the general public will be likely to judge the merits of the question by its opinions as to economic and service results achieved under direct government control in comparison with the results of previous operations under corporate management.

"Government control of the railroad systems of the country during the war has been universally recognized as a wise procedure, because of the necessity of subordinating the individual interests of the various railroads to the all-important idea of securing the maximum of transportation service throughout the country for the movement of troops and essential commodities. The serious curtailment of the usual passenger and freight service, coincident with the greatly increased charges for both classes of service, has been accepted by the public as necessary to the quickest possible success of the war program.

"Now that hostilities have ceased, the railroad administration will be judged by other standards than those of war necessities, and already the editorial columns of prominent papers are extremely critical of the operating and financial results of government control. In the opinion of your committee, there is nothing in the experience of the government thus far to justify or encourage permanent public operation of the railroads either from the standpoint of economics or of service, and while doubtless the ardent advocates of public ownership will seek to capitalize recent experiences of the government in favor of their theories, it is indisputable that those who travel on the railroads and those using them regularly for shipping are anxious for the termination of direct government operation as soon as may be practicable."

A section of the report is devoted to street railways. Commenting that the condition of these properties "is rapidly becoming desperate," the committee then refers to the suggestion in some quarters that the most practicable and effective solution is in municipal ownership since that would mean that the additional revenue required would be forthcoming either through increased fares or indirectly through taxation. It adds:

"We recognize the extremity of the street car companies and the advantage that such suggestion may offer to some of them individually, but we deem it necessary to say that the opinion of your public policy committee, as hitherto frequently expressed, continues with increasing conviction that municipal ownership of electric lighting, gas and street railway companies is economically unsound and cannot redound to the mutual benefit of the consumers and the municipality. We think it is but fair publicly to reaffirm our views upon this subject at this time when temptation to the encouragement of municipal ownership by utilities companies themselves seems apparent."

The public policy committee is composed of H. G. Bradlee, N. F. Brady, J. A. Britton, E. W. Burdett, Walton Clark, H. L. Doherty, C. L. Edgar, Samuel Insull, J. W. Lieb, J. B. McCall, T. E. Murray, H. A. Wagner, W. F. Wells, ex officio; W. W. Freeman, chairman.

GOOD ATTENDANCE AT THE A.I.E.E. MIDWINTER CONVENTION

Prof. Comfort A. Adams, Presiding at Opening Joint Session with American Institute of Mining Engineers, Tells of Welding Society

Preliminary registration indicated a good attendance at the midwinter convention of the American Institute of Electrical Engineers held from Wednesday to Friday of this week at the Engineering Societies Building, New York. A joint technical session with the American Institute of Mining Engineers on Wednesday afternoon opened the convention. Prof. Comfort A. Adams, president of the A. I. E. E., who presided, spoke of the plan to form an electric welding society, composed of representatives of manufacturers, engineers and the government. A full report of the convention will be printed in next week's issue of the ELECTRICAL WORLD.

FOREIGN TRADE WORK OF THE ASSOCIATED MANUFACTURERS

Outline of Information Regarding Elements of Cost Desired by International Trade Committee for Use in Its Studies

A letter to members of the Associated Manufacturers of Electrical Supplies by William Burgess, adviser to the international trade committee, outlines the method to be followed in giving information for the use of the committee. Mr. Burgess says that in obtaining proper tariff protection it is necessary to know all elements of cost, both factory and merchandising, so as to compare them with similar elements of foreign costs. Factory cost, in this instance, means the addition of all elements entering into the total factory cost of the goods, packed and ready for shipment, approximately figured, but does not include merchandising costs.

The elements of cost should be divided, Mr. Burgess adds, under six main headings, viz.:

1. Direct Materials.—All materials entering directly into the article produced, including freight and other charges thereon.
2. Indirect Materials.—All other materials used in the process of manufacture, such as coal or other fuel, mold and die materials, etc., including freight and other charges thereon.
3. Direct Labor.—All labor directly employed in the making of an article.
4. Indirect Labor.—All other labor or payroll costs, such as superintendents, foremen, firemen, watchmen, designers, draftsmen, engineers, factory clerk hire, etc.
5. Factory Overhead.—All rents or interest on factory investments, depreciation of plant, repairs to buildings, maintenance of machinery and equipment, insurance and taxes of all kinds, light, water, royalties on patents and all other factory expenditures.
6. Merchandising.—All selling and administrative costs, including officers' salaries, commissions, traveling expenses, advertising, etc.

If more convenient to group under one heading all materials indicated in 1 and 2 as total material cost, and all labor, as in 2 and 3, as total labor cost, it will be satisfactory, although a separate grouping is more desirable for the special purpose in view, according to Mr. Burgess.

The information desired is to be given on a percentage basis, thus avoiding the giving of any figures which might be considered confidential or private. All reports, however, are to be considered strictly confidential and only the total averages will be used in any public way.

The committee also desires information as to the approximate average normal earnings per hour of employees, divided between male and female and skilled and unskilled labor, over and under sixteen years of age.

EFFECT OF ECONOMIES IN WAR-TIME LIGHTING

Reduction of $5,000 in Revenue in York, Pa., with Saving of 100 Net Tons of Coal, Valued at $500, During Six Months of 1918

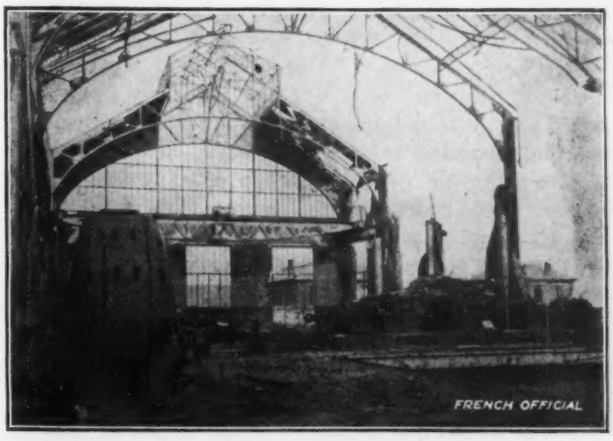
Gordon Campbell, president York (Pa.) Railways Company, gives in his annual report for the year ended Nov. 30, 1918, the following particulars regarding the effect of war economies:

In the lighting department receipts have been diminished by orders of the Fuel Administration curtailing lighting and advising economy.

As to the effect of these economies, it might be interesting to note that during the six months of summer the energy sold for lighting decreased 76,605 kw.-hr. and the loss in revenue was approximately $5000. The resultant reduction in coal consumption was hardly 100 net tons, which, at $5 per ton, amounted to $500.

With the advanced cost of fuel and labor, curtailment of revenue from this source was an added hardship. Nevertheless, the company loyally coöperated with orders and suggestions for fuel economies. Both railway and lighting receipts were also seriously affected by the epidemic of influenza during the fall of 1918.

Destruction Wrought by the Germans in Northern France



All except the heaviest of the machinery in the power plant of the Pas de Calais Department in France was removed by the German invaders. The picture shows what was left of the plant.

PRESENT STATUS OF THE BOSTON EDISON RATE CASE

Hearings to Be Resumed March 17, and Company Is Preparing Answers to Queries Covering a Wide Range of Subjects

Hearings in the Boston Edison company rate case before the Massachusetts Gas and Electric Light Commission will be resumed March 17. Three public hearings were held during January, the time being devoted to the consideration of sixty-nine interrogations propounded by the petitioners for lower rates, who are represented by Maurice Palais. These queries in regard to earnings, billing meter arrangements, classification, etc., cover a wide range and in some cases their answer involves so much time, labor and expense that the commission has ruled informally that they be simplified or else abandoned. During the interim the company will prepare as many answers as possible for use at further hearings in the case.

DEALERS IN LIGHTING FIXTURES NOW ORGANIZE

National Council of Lighting Fixture Manufacturers and Illuminating Glass Manufacturers' Association Are Formed

The convention of the Lighting Fixture Dealers' Society of America in Pittsburgh on Feb. 10 and 11 was responsible for bringing two new trade associations into existence. Among those attending the convention were representatives of leading fixture manufacturers and manufacturers of illuminating glassware. These two interests organized associations of their own while in Pittsburgh—the National Council of Lighting Fixture Manufacturers and the Illuminating Glass Manufacturers' Association.

Fred R. Farmer, president of the Beardslee Chandelier Manufacturing Company, Chicago, was elected president of the National Council of Fixture Manufacturers; Albert Wahle, of the Cassidy & Son Manufacturing Company, New York, vice-president, and Charles H. Hofrichter, of the Crescent Brass Manufacturing Company, Cleveland, secretary-treasurer.

Charles Ott, of the Eagle Glass & Manufacturing Company, Wellsburg, West Va., was elected president of the Illuminating Glass Manufacturers' Association. Conrad J. Netting, of the C. J. Netting Company, Detroit, was reëlected president of the Lighting Dealers' Society of America.

Commenting on the organization of a fixture manufacturers' association, Mr. Farmer said:

> The formation of a National Council of Lighting Fixture Manufacturers has been attempted many times before but without success. This year a new spirit seemed to animate the representatives of the industry—a spirit of coöperation—a realization that individual interests must be subordinated to the common good. There is much work of an educational nature that we can do better collectively than individually. The radical improvements that have been made in recent years in lighting fixtures are not generally known. People are still satisfied with the inartistic and inefficient fixtures installed a decade ago because they do not realize the greater comfort and economy of modern fixtures. We believe that by closer coöperation with fixture dealers we can greatly augment the volume of replacement business. Another object of our national council is to suppress existing trade evils, particularly the practice of copying one another's designs.

The next meeting of the National Council of Lighting Fixture Manufacturers will be called early in the summer to perfect organization. Any fixture manufacturer who would be eligible for membership in a local association of fixture manufacturers is eligible for membership in the National Council.

REFUSE DARKNESS FOR BOLSHEVIKS IN SEATTLE

"Not a Light Blinked," Says Superintendent of Lighting Ross — Hundreds of Citizens Reported to Help in the Emergency

Some details of the success with which electric service was maintained in Seattle, Wash., during the general strike there from Feb. 6 to Feb. 10 were printed in last week's issue of the ELECTRICAL WORLD. A letter to a representative of this journal from J. D. Ross, superintendent of lighting of the city of Seattle, gives the following additional particulars:

> You are conversant with most of the details of the present strike. Bolshevik handbills, "Russia Did It" and "The Revolution Is Now On," were distributed. The great mass of union men were dominated by a few radicals. They demanded that all homes and streets be in darkness. Only a few of our men responded, and not a light blinked. We therefore became the first to fight the revolutionary program of the "general strike." I believe this is the first time it has been invoked in America. Twenty-five thousand men left the shipyards, and then all other trades were called on to walk out—probably as many more.
>
> City light stood fast, and of the 400 men only a few went out, so we are stronger to-day than ever. One of the novel features was that, as stations are scattered, Seattle being 20 miles long, tampering with telephone lines would isolate a station, so I thought of wireless and found a number of sets with the Kilbourne & Clarke Company. These were loaned free of charge. E. C. Kilbourne and R. O. Hall, the manager, worked all night helping us install them. One was put in the Federal Building, and our stations were in instant touch with each other and Uncle Sam and local stations, thence Bremerton Navy Yard and Camp Lewis. Three shifts of operators were used. I think this is the first time this has been done. Of course, it is a perfect system, as aerials are not necessarily high and may consist of one temporary wire.
>
> Another feature was that hundreds of citizens from all classes reported to help in the emergency, many of them who could not be used staying in the office or keeping in touch all day to act as anything from engineer to errand boy. Old men turned away disappointed that they could not be used as guards. A number were union men loyal to their city. A steady stream came in all day long.

RESCINDS ITS WAR RULING ON ELECTRIC EXTENSIONS

Public Utilities Commission of Illinois Annuls Amendments Designed to Conserve Use of Capital for Line Extensions in War Time

The Public Utilities Commission of Illinois has entered an order, effective as of March 1, 1919, annuling and canceling all amendments to Rules 19 and 31 which were intended to conserve the capital of utilities that might have been expended in line extensions during the war.

A. S. M. E., Spring Meeting.—June 17 to June 20 has been tentatively chosen as the time for the spring meeting of the American Society of Mechanical Engineers in Detroit.

New Member Society in Engineering Council.—The American Society for Testing Materials has become a member of the Engineering Council, thus bringing the membership up to six.

A. I. and S. E. E., Cleveland District Section.—"Telephones" will be discussed at the March 1 meeting of the Cleveland District Section, Association of Iron and Steel Electrical Engineers.

New York Electrical Society.—A. Russell Bond, managing editor of the *Scientific American*, lectured on "Deep-Sea Salvage After the War" before the Feb. 19 meeting of the New York Electrical Society.

Electric Club of Chicago. — Dr. Scherger, Armour Institute of Technology, spoke on the history and meaning of Bolshevism at the Feb. 6 luncheon, while on Feb. 13 Capt. Oliver T. Reilly told of his war experiences.

Engineers' Club of Philadelphia.—Alfred D. Flinn, secretary of the Engineering Council, will speak on "Joint Activities of Engineers, a Résumé of the Work of the Engineering Council and Foundation," at the luncheon on March 4.

I. E. S. New England Section.—Preston S. Millar, general manager of the Electrical Testing Laboratories, New York City, spoke on "Lighting in War Time" before the New England Section of the Illuminating Engineering Society on Feb. 18.

A. I. and S. E. E., Philadelphia Section.—"The Substitution of Electric for Hydraulic Power in Steel Mills" will be the subject of R. B. Gerhart, electrical engineer of the Bethlehem Steel Company's Sparrows Point (Md.) plant, at the March 1 meeting of this section of the Association of Iron and Steel Electrical Engineers.

Jovian League, Kansas City Chapter.—The first rejuvenation of the Kansas City Jovian League in eighteen months was held on Feb. 8. Speeches were made by Reigning Jupiter L. C. Ripley, J. F. Porter, president of the Kansas City Light & Power Company, and H. C. Blackwell, vice-president and general manager of this company.

N. A. E. C. and D., Missouri State Section.—Trade conditions, construction, outlook costs and coöperation were among the topics discussed at the Feb. 8 meeting of the Missouri State Association of Electrical Contractors and Dealers in Kansas City. W. J. Squire, Kansas City, was elected chairman of the state board of directors, and W. L. Hutchinson was elected secretary.

N. E. L. A., Philadelphia Electric Company Section.—Clifford W. Bates spoke on "Fundamental Principles of Electrical Apparatus" and F. D. Day on "Keeping Tabs on Customers' Meter Registration for Billing Purposes" on Feb. 11 before the meter department branch of the Philadelphia Electric Company Section, National Electric Light Association. "Underground Construction" was the subject presented by L. G. Kraft before the engineering branch on Feb. 18.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Massachusetts State Association of Electrical Contractors and Dealers.—A special meeting of the Massachusetts State Association of Electrical Contractors and Dealers will be held in the American House, Boston, on Feb. 25. At this time George J. Murphy, chairman of the accounting committee of the National Electrical Credit Men's Association, will discuss the accounting system which has been adopted by the National Association of Electrical Contractors and Dealers. J. E. Wilson, 263 Summer Street, Boston, is state secretary.

San Francisco Electrical Development League.—At the weekly luncheon of the league on Jan. 24 there was a symposium on the subject of "How to Wire Houses so as to Care for Socket Appliances," participated in by men speaking from the viewpoint of five different branches of the industry. L. H. Newbert spoke for the California Electrical Coöperative Campaign; E. N. Brown represented the manufacturers; W. D. Kohlwey spoke from the retailers' point of view; Arthur Kempsten represented the city department of electricity, and Clyde Chamblin spoke for the electrical contractors.

War Activities of Illuminating Engineering Society.—Civilian lighting in war time in connection with the activities of the war service committee of the Illuminating Engineering Society was the topic of a paper presented by P. S. Millar before the New York Section of the society on Feb. 13. The promotion of production, providing protection for properties, promoting safety and conservation were the four principles for which the committee worked. Some of the most notable work was that of W. A. Durgin, who increased production of industrial plants in Chicago from 30 to 100 per cent. H. A. Hornor told of problems in lighting shipyards. According to him the electrical and the illuminating engineer will be standbies of shipbuilders and will be called upon to solve many problems which now are confronting this industry. The chair was filled jointly by Dr. G. A. Hoadley, president of the society, and F. M. Feiker, editorial director of the ELECTRICAL WORLD, chairman of the New York Section. The papers were discussed by Dr. A. S. McAllister, F. D. Pembleton, J. A. Somers, H. D'Olier, Jr., S. E. Doane and G. H. Stickney.

American Institute of Electrical Engineers

San Francisco Section.—Joseph N. LeConte recently presented a paper on "New Charts for the Ascertaining of Sag Constants in Aërial Suspension."

Toronto Section.—R. C. Harris, Commissioner of Works for Toronto, gave an illustrated lecture on "The Bloor Street Viaduct" at a recent meeting.

Schenectady Section.—"Our Foreign Commercial Relations" was the subject of Dr. Frank R. Rutter, Bureau of Foreign and Domestic Commerce, Washington, D. C., at the Feb. 7 meeting.

Lynn Section.—An illustrated address was delivered by C. A. Kelsey of the power and mining engineering department of the General Electric Company on "The Sugar Industry" on Feb. 12.

St. Louis Section.—At the annual meeting on Jan. 28 J. L. Hamilton was elected chairman, H. G. Hake secretary, and H. W. Eales was appointed to represent the section on the joint council of the associated engineering societies of St. Louis. Dr. J. J. Kessler gave a paper on "Materials of Machine Insulation," discussing briefly each material and noting its good points and drawbacks.

Baltimore Section.—The Baltimore Sections of the A. I. E. E., A. S. C. E. and A. I. M. E. met jointly with the Maryland Section of the American Chemical Society and the Engineers' Club of Baltimore on Feb. 14 to hear F. B. Craft, assistant chief engineer of the Western Electric Company, on "Electrical Communications in War Times." Lantern slides and moving pictures were shown with this talk, in which wireless telegraphy and telephony received particular attention.

Program for the March Meeting at Boston.—On March 14 the American Institute of Electrical Engineers will hold its three hundred and forty-eighth meeting in Boston. At the morning session papers will be presented by Drs. A. E. Kennelly and H. Nukiyama on "Electromagnetic Theory of the Telephone Receiver with Special Reference to Motional Impedance," and by Dr. A. G. Webster on "The Absolute Measurement of the Intensity of Sound." Following a general discussion of these papers there will be an exhibition of the A. I. E. E. tablet commemorating the work of William D. Weaver, former editor of the ELECTRICAL WORLD. Calvert Townley will speak in the afternoon, his subject being "The Rehabilitation of Our Transportation System with Particular Reference to Electrification." Following a dinner in the evening addresses will be given by Dr. Charles W. Eliot on "University Training for Engineers," by Prof. Harry Clifford on "Science and the Engineer," by Prof. E. B. Wilson on "Mathematics and the Engineer," by Dr. A. G. Webster on "The Place of Science in Engineering," and by Saul Dushman on "Our Mental Attitude Toward Scientific Investigation."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Decision in Wireless Apparatus Suit.—The Court of Error, which is the court of last resort in the State of New Jersey, has affirmed Vice-Chancellor Lane's judgment awarding royalties of $300,000 to the International Radio Telegraph Company of New York. This payment covers the right to use patents owned by the International company in a large quantity of wireless-telegraph apparatus made by the Marconi company and supplied to the Navy Department during the war. Suit for recovery of the royalties was brought under a contract between the two companies. The decision made last fall was appealed by the Marconi company.

Electric Club Statistics.—A few statistics have been compiled from the report of the auditor of the Electric Club of Chicago for 1918. This club now has about 750 members. Its initiation fee is $5, and its annual dues are $5. The total income from all sources was $4,388.80. Of this amount $1,304.82 was invested in Liberty bonds. For entertainment $621.07 was expended. There was an average attendance on the part of each member of six times during the year, or 15 per cent. During the year forty-three bulletins were published at a total cost of $775.01. Committee work cost $227.25. Administration expense amounted to $1,057.22. This includes $461.19 for such general expenses as stationery, printing and postage and $393.50 for clerical hire in the secretary-treasurer's office. The lowest attendance at any meeting in 1918 was 59, the highest was 266, and the average was 123.

Columbus (Ohio) Changes.—In order to insure its slate of directors at the annual meeting of stockholders of the Columbus (Ohio) Railway, Light & Power Company, the proxy committee secured an increase of two members in the personnel of the board. The new board consists of W. C. Willard, W. A. Gill, Norman McD. Crawford, Charles L. Kurtz, D. Meade Massie, A. S. Hammond, Walter B. Beebe, Samuel Ungerleider, Emil Keisewetter, F. R. Huntington, Harry S. Holton, B. W. Marr, E. A. Reed and Frank P. Hall. The last four are new members nominated by the proxy committee. One of them succeeds E. K. Stewart, recently resigned, and another takes the place of R. H. Platt, who was elected at the reorganization meeting but could not serve because of pressure of other interests. The other two are the additional members, making fourteen in all, instead of twelve. The board is now fully in the hands of the stockholders' protective committee, which will soon pass out of existence, since its purpose has been accomplished. The board organized by the election of the following officers: President, Charles L. Kurtz; vice-president and treasurer, Norman McD. Crawford; vice-president, Samuel Ungerleider; secretary and auditor, P. V. Burington; assistant secretary and auditor, H. M. Burington; executive committee, Charles L. Kurtz, F. R. Huntington and Walter B. Beebe. Harold W. Clapp was retained as general manager. The annual report shows a decrease of $168,933 in railway operating revenue and an increase of $410,158 in power and light revenue.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Maintaining Integrity of the Investment.—In authorizing new electric rates for the Heppner Light & Water Company the Oregon Public Service Commission says in part: "The commission believes that a slight overdevelopment of the electric system in Heppner has resulted in fixed charges and operating costs somewhat beyond the ready ability of the community adequately to defray. But to criticise the past zeal or judgment of the management of the company or the requirements of the municipality in this respect will not tend to alleviate the present urgent need for relief which the utility faces. Normally a public utility is entitled to sufficient revenue from its operations to meet fully its necessary production and distribution expenses and to provide a fair and reasonable return on the fair value of the property. But there are certain other correlated bases which must be given due weight. The first and most important of these is the value of the service to the consumer, in order that we may avoid the imposition of prohibitive rates which in themselves by loss of business might defeat the purpose of increased revenue sought by the higher rates. More important than a profit on the investment is the preservation of the integrity of the capital investment itself, and this phase of the subject deserves the commission's first consideration, in order that the community may be assured of uninterrupted electric service. While the advanced rates may not allow an appreciable return on the investment, it is believed that, coupled with the practice by the utility of rigid economies in overhead expenses, fuel consumption and operation, and by extension of the metered service, they will insure the stability of the investment in the system under the present onerous conditions."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Negligence as to Inexperienced Employee.—Employer knowing that duty of turning on electric switch was dangerous, and that employee was ignorant of such danger, was negligent in ordering employee to turn on switch, the Court of Civil Appeals of Texas held (207 S. W. 967).

Extent of Jurisdiction of Commission.—The public service commission law, giving the commission power to fix rates, is applicable to the city of St. Louis, in view of Constitution 1875, Article 9, Section 23, providing that the "charter and amendments shall always be in harmony and subject to the constitution and laws of Missouri," and Section 25, giving the General Assembly the same power over such city as over other cities, according to the Supreme Court of Missouri (207 S.W. 799).

Double Indemnity Recovery.—In the case of an electrician fatally burned as a proximate result of a sudden flash at a switchboard installed along the inside of a building, occasioned by a short circuit which threw oil over him, ignited his clothing and partly burned the switchboard, double indemnity could not be recovered under accident policy provision for double indemnity for injuries "by reason and in consequence of the burning of a building while the insured is therein," the St. Louis Court of Appeals held (207 S. 281).

Effect of Higher Rates on Contract.—Private contract with a public service electric company, fixing rates, is subject to the police power of regulation, so that exercise thereof, by fixing a higher rate, does not impair obligation of contract, according to the Supreme Court of Georgia (39 S. C. R. 117). One having a contract with a public service electric company fixing rates is not deprived of property without due process by the fixing of higher rates in the exercise of the state's police power of regulation.

Rates Jurisdiction of Commission.—Where a city enters into a contract with a light and power company by the terms of which the city sells its municipal light plant to the company, and as part of the consideration the company agrees to furnish electric energy to the inhabitants of the city at rates mentioned in the contract for a fixed period, the Corporation Commission has jurisdiction to make an order authorizing a change in the schedule of rates, the Supreme Court of Oklahoma held (177 P. 361) in City of Durant versus Consumers' Light & Power Company.

Elmer Dover, vice-president of H. M. Byllesby & Company in charge of the Byllesby properties in the Pacific Northwest, resigned on Feb. 1.

Charles G. Adsit, for several years advisory and consulting engineer of the executive department of the Georgia Railway & Power Company, Atlanta, Ga., has been appointed consulting engineer for all departments of the company. Mr. Adsit has been closely identified with several big engineering tasks which the company has undertaken since it entered upon the Tallulah Falls development.

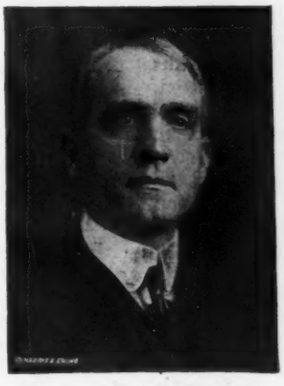
William Rawson Collier, sales manager of the Georgia Railway & Power Company, Atlanta, Ga., has been appointed operating manager of the electrical department of the company in addition to his duties as sales manager. Mr. Collier upon graduation from the Massachusetts Institute of Technology entered the consulting engineering field as junior member of the firm of Collier & Browne. In 1902 he entered the service of the Georgia Railway & Power Company in charge of the drafting department. Four years later he was appointed contract agent, resigning in 1907 to become manager of the Electric Manufacturing & Equipment Company. Upon the dissolution of this company he became associated with the B-R Electric Company as engineer, which position he held until the formation of the present Georgia Railway & Power Company, when he was appointed sales manager. In addition he became sales manager of the Atlanta Gas Light Company, manager of the Carrollton Electric Company and manager of the Suburban Gas & Electric Company, holding these two latter positions until the companies were merged with the parent organization.

Stuart Wilder has resigned from the public service companies with which he was formerly identified and has become chief engineer of the Russell, Burdsall & Ward Bolt & Nut Company, Port Chester, N. Y., Pemberwick, Conn., and Rock Falls, Ill. Mr. Wilder was born in Rockwood, Tenn., in 1872. After being graduated from Swarthmore College, he was identified with lumber and railroad interests in Tennessee for some time and then became connected with the Stanley Electric & Manufacturing Company of Pittsfield, Mass. Later he joined the staff of Sanderson & Porter, engineers and contractors of New York City, leaving to become assistant electrical engineer of the Westchester Lighting Company, Mount Vernon, N. Y. Since 1914 he has been chief electrical engineer for that company. In 1905 he was made vice-president and general manager of the Northern Westchester Lighting Company, Ossining, N. Y., and vice-president and general manager of the Peekskill (N. Y.) Lighting & Railroad Company. Mr. Wilder is a past-president of the Empire State Gas & Electric Association and a past vice-president of the New York Railways Association.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Philip H. Gadsden of Charleston, S. C., who was chairman of the American Electric Railway War Board and is now chairman of its successor, the committee on national relations of the association, and also chairman of its committee on readjustment, has been elected vice-president of the United Gas Improvement Company of Philadelphia and will take charge of a new department of national public relations of that organization. For some time Mr. Gadsden has been president of the Charleston Consolidated Railway & Lighting Company, which is controlled by the U. G. I., but in which he is personally a heavy owner. During the war, however, he has made his headquarters at Washington, where he has attained national prominence in connection with his work in behalf of public utilities. The new activities which Mr. Gadsden is about to undertake are not expected to interfere with his continued interest in the association work. Mr. Gadsden was born in Charleston fifty-one years ago. He was educated in the schools of that city, and afterward in the South Carolina University, at Columbia. The same university has conferred upon him the degree of LL.D. He is a lawyer, and has practiced at the bar for fifteen years.



P. H. GADSDEN

Obituary

Frank Morris Baum, retired vice-president and general manager of the Portland Wood Pipe Company, who for eight years was State Senator from Spokane County, Wash., died on Feb. 5 in Pasadena, Cal.

William W. Henry, assistant electrical engineer of the electrical department of the Georgia Railway & Power Company, Atlanta, died on Jan. 19. Mr. Henry was with the company for fifteen years. Most of that time he was investigator of the engineering division of the electrical department. He was promoted to the position he held at the time of his death but a few months ago.

Roland T. Oakes, for many years prominent in the electrical trade at Holyoke, Mass., died at Holyoke Feb. 10. He was born in Athol, Mass., in 1835. Mr. Oakes entered the electrical field in 1880 in the firm of the Amherst Motor Company, and in 1885 he retired from this organization and established an electrical store, Arthur J. Newell entering the business with him a year later. The firm was incorporated in 1892. In 1912 Mr. Oakes sold a controlling interest in the firm to Mr. Newell and retired from business. The house is one of the largest supply and contracting establishments in the upper Connecticut valley.

Henry S. Anderson, for seventeen years associated with electric lighting interests in Springfield, Mass., died recently in Toronto, Ont., at the age of forty-eight. Mr. Anderson was born in East Orange, N. J., and later attended the Massachusetts Institute of Technology. He left at the age of seventeen to enter the service of the United Electric Light Company, Springfield, as an office boy. Promotion was rapid, and he finally became general manager of the company. During the last twelve years Mr. Anderson had made his home in Toronto, where he was prominent in the electrical supply field and also in mining and other outside interests.

Philip Henry Wynne, an inventor of electrical instruments of precision, died at Deerfield, Mass., Feb. 11, at the age of fifty-one years. After a course of study in the Massachusetts Institute of Technology he entered the employ of the Illinois Steel Company at Chicago, soon joining the organization of the Thomson-Houston Electric Company at Lynn, Mass. After several years he was employed by the Boston Elevated Railway Company for about two years in varied work in the engineering department in connection with the building and electrical equipment of the rapid transit system, including calculations and tests. For ten years thereafter he engaged in the design of scientific instruments, for a time being employed by the L. E. Knott Apparatus Company of Boston. A short teaching period in the university at Austin, Tex., was followed by his return to Springfield, Mass., where he made his home for the rest of his life, spending the summer in Old Deerfield and as his health permitted devoting himself to musical composition. Mr. Wynne's inventions include precision galvanometers and an ore separator. He was a man of acute scientific insight and marked artistic genius.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

SLACK SEASON IS USED AS EDUCATIONAL PERIOD

Outside Salesmen Have Opportunity to Instruct Retailers in the Principles of Operation and Construction of Socket Appliances

One of the prominent electrical supply jobbing concerns of the country, while looking for a lessened buying activity among its customers for the next few months, still feels that salesmen can be profitably kept outside. This concern is instructing its salesmen to use this time to educate retailers thoroughly in the rapidly growing line of socket devices and other electrical appliances handled by the house. It has been some time since jobbers or manufacturers could devote any considerable time to such work. Retail distributers of electrical goods are contractor-dealers, central stations, dry-goods stores, hardware stores, drug stores, and recently it has been noticed that a prominent grocery concern in the East is distributing incandescent lamps. Thus there is a wide expansion in the field of retail distribution. It stands to reason that, outside of the central station perhaps, an amount of education by no means small is necessary if the retailing salespeople are to be fully conversant with the qualities of the lines handled. Where the first cost of the article is apparently great, as with the fan, vacuum cleaner or washing machine, the salesman must have a pretty sound education in the merits of his wares.

This practice of utilizing the present to prepare for the future has been urged upon the industry before. In this instance an idea in offered to both jobbers and manufacturers. When the time comes for big business the distributers' representatives will not have so much time to devote to such education.

CANCELLATION PRIVILEGE IS NOW BEING ABUSED

Suggestion Is Made that Electrical Manufacturers Should Require the Payment of a Cancellation Charge in Such Cases

Immediately upon the signing of the armistice in November last manufacturers began to receive cancellation orders not only from the government but also from other customers. Even where orders were supposed to be firm, cancellations came in.

Electrical manufacturers, of course, were hard hit by this situation because long deliveries had occasioned the placing of orders far in advance. On some of the large equipment, for instance, it was impossible in November to get promises of deliveries prior to 1920. Shipments of heating appliances are still taking place on back orders.

Of course, the manufacturers are really to blame for allowing the practice of cancellation to go as far as it has. To be sure, the manufacturer in the past has felt that if the customers could be accommodated without too much trouble or expense it was the proper thing to do. As a result the cancellation privilege has been abused and the manufacturers in order to protect themselves and their employees must take some vigorous action.

It has been suggested by a prominent electrical manufacturer that the remedy for this abuse is a cancellation charge. The manufacturer has been put to a certain expense in taking and holding the order. With an accumulation of orders he may have gone ahead and made arrangements for raw materials, new machinery, additional labor, additional factory space, etc. Besides, it costs a certain amount of money just to book an order and the same work to take that order off the books. Some one has to pay these charges. If the one canceling the order doesn't, the charges go against general expense and must therefore be absorbed by the customer who sticks by his contract.

The manufacturers have to pay such a charge to get out of their raw-material contracts. Only a couple of weeks ago an instance came up where a cable manufacturer paid $45,000 to be released from his cotton-yarn contract. If such is the condition, it does not seem unreasonable to require a cancellation charge of the electrical manufacturer's customer where cancellation is allowed.

PRODUCTION OF LAMPS ON PACIFIC COAST LARGE

With Local Manufacture in Full Blast the Necessity for the Trade's Carrying Large Stocks Has Greatly Diminished

Incandescent-lamp trade on the Pacific Coast has been aided materially in the last eighteen months by the fact that a lamp factory is located at Oakland, Cal. This is the only one west of Chicago, and, needless to say, it has been working at capacity during the times of abnormal demand. The 1,000,000 lamps per month which the plant turned out not only relieved the local situation materially but supplied greatly needed orders for government cantonments and navy yards. By manufacturing the stock as wanted the trade has been saved the necessity for carrying large quantities of lamps on hand, this being one of the disadvantages peculiar to the Pacific Coast trade in lines which have no Western factories.

The plant has about 500 employees. All types, including gas-filled lamps, are manufactured, excepting only the minature sizes. Shipment is made to the trade in Oregon, Washington, California and Arizona. It is a well-known fact that the Western trade is very loyal to home industry, and the Oakland plant has received much encouragement on this score. Typical of such encouragement is the California state contract, which now calls for about $20,000 worth of lamps per annum.

SOME PRICE DEVELOPMENTS OF AN INTERESTING NATURE

Certain Items with High Manufacturing Cost Increase in Spite of the Decreasing Prices of Raw Materials

Some interesting developments in the price situation have come up within the past few days. At this time, when everybody is looking for lower prices, when prices of raw materials are rapidly approaching the level of normal times, prices on certain items of schedule material have been advanced. This increase, which is on the whole in the neighborhood of 15 per cent less discount, seems to be an emphatic answer by the manufacturers to the increasing

number of inquiries regarding the probable date of lower prices.

In the item of increased price, the element of raw-material costs is not large. A drop of 9 cents in the price of copper has no appreciable effect on the price of screw plugs, for instance. The big cost is the manufacturing cost. In other words, some reduction in the labor cost, either through lower wages or greater output per worker, seems necessary before any very great drop can come in these lines.

In some kinds of schedule material the raw-material item is, of course, an appreciable part of the cost of the finished product. In such lines it would be more natural to expect a price revision when raw materials are substantially reduced than in those lines where the cost of raw materials figures but slightly in the individual item.

It must also be remembered that the manufacturers are probably not running on 100 per cent capacity but that a number of machines are idle. This, of course, increases the overhead charges proportionately on the products turned out. In fact, it would not be surprising if this item was one of the largest factors in the price situation at the present time.

METAL MARKET SITUATION

The Price Is Still Holding Back Sales in Any Volume, Although Some Copper Moved

The price question, more than any other single factor, dominates the economic situation, according to *Dun's Review*. Purchasing only for immediate and well-defined necessities, which has continued to be the rule for several weeks in most leading branches, has brought a sharp industrial reversal, and strikes have been but a contributing cause of the steadily diminishing activities and lessening employment of labor.

Copper sold nominally at 17½ cents, but some was quoted as low as 17 cents by small producers. It declined from 1 cent to 1½ cents per pound as compared with the past week, and sales of approximately 10,000,000 lb. were recorded, including some speculative transactions. Exports amounted to 5265 tons last week, mostly to Great Britain. There was a drop amounting to nearly £5 per ton in the London market.

Import licenses for shipment of tin to this country are not yet possible. British export restrictions on tin are reported to have been lifted. Spot tin in the London market has declined £13.

Spot spelter is off slightly, as is antimony. As for old metals, no large price changes are noticeable. Scrap zinc, which increased slightly the previous week, came down to a still lower level. Heavy brass declined slightly.

NEW YORK METAL MARKET PRICES

	Feb. 10	Feb. 18
Copper:	£ s d	£ s d
London, standard spot	80 0 0	74 10 0
	Cents per Pound	Cents pr Pound
Prime Lake	18.50	17.50 to 18.00
Electrolytic	18.00	16.75
Casting	17.25	16.50
Wire base	21.75	20.75
Lead, trust price	5.00	5.00
Antimony	7.37½	7.25
Nickel, ingot	40.00	40.00
Sheet zinc, f. o. b. smelter	11.00	11.00
Spelter, spot	6.85	6.72½
Tin	Govt. price 72.50	Govt. price 72.50
Aluminum, 98 to 99 per cent	Govt. price 33.10	31.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	14.50 to 15.00	14.50 to 14.75
Brass, heavy	8.00 to 8.25	7.75 to 8.00
Brass, light	6.50 to 6.75	6.50 to 6.75
Lead, heavy	4.00 to 4.25	4.00 to 4.25
Zinc, old scrap	5.25 to 5.50	4.75 to 5.00

THE WEEK
IN TRADE

INQUIRIES apparently are becoming more numerous. Orders are still of the hand-to-mouth variety and consequently are rather numerous but small. Motor-driven appliance manufacturers are ordering fractional-horsepower motors somewhat freely.

Some building projects are coming through, but it is still too early for ground to be broken. Local stocks of electrical supplies are in good shape and can adequately take care of any building that takes place.

Shipments on back orders are still going forward, but, generally speaking, this work, especially on small articles, is about completed. Local and factory stocks are again being built up, and in certain cases of small motor manufacturers are reported as being in rather good shape.

Raw-material prices are lower, but labor shows no lower cost. As a consequence some items of schedule material have advanced in price slightly. Wire, however, is again lower.

Labor is very unquiet, but local disturbances seem to be well in hand. They have, however, a bad effect on local tradesmen and thereby tend further to diminish buying.

The reports of the United States Employment Service for last week show an increase of the cities reporting heavy unemployment of 57 per cent to 58 per cent. The cities reporting the demand equal to the supply have dropped from 32 per cent to 29 per cent. Non-employment reported for last week was 321,785, an increase of 30,954.

NEW YORK

Large building projects have been more quiet than usual this week. Secretary Glass stated that it was his impression that inactivity in building trades was directly traceable, not to any insufficiency of credit, but to the continuance of abnormally high costs. Building and loan associations are endeavoring to utilize more of their large deposits in fostering private building through more advantageous relations with Federal Reserve banks and through longer mortgages on the houses. On Feb. 17 the general strike of building mechanics on contracts of members of the Building Trades Employers' Association began.

General trade conditions have not materially improved. Wire has been still lower this week, but prices on certain items of schedule material have stiffened slightly.

FLEXIBLE NON-METALLIC CONDUIT.—The market for large orders continues quiet pending opening up of building construction. Manufacturers report no ground for expectation of decline in prices regardless of drop in cotton. High labor charge continues to be the main item in that respect.

LARGE MOTORS.—One manufacturer reports several orders in the last two weeks, while other manufacturers report no movement.

SMALL MOTORS.—One manufacturer has reported good sales, another that his factory is busy with left-over orders, and a third reports nothing satisfactory.

FRACTIONAL-HORSEPOWER MOTORS.—Orders have been reported as very satisfactory, especially from manufacturers of washing machine and of office appliances.

COPPER LUGS.—A discount sheet dated Feb. 1, sent out by a prominent New England manufacturer of copper-wire terminals, shows prices on certain sizes as follows: 5000 or more of one size, 45 per cent, 1000 to 4999; 40 per cent, 1 to 999, list.

SOCKET DEVICES.—Sales have not been very satisfactory on this general class of material, although certain devices in different localities have moved well. Department

stores and jobbers have rather large stocks and on this account some are cutting prices. Washing machines and vacuum cleaners are moving in good shape. Heaters are very quiet at this time, but dealers expect large sales in the spring when furnace heating begins to fall off.

ATTACHMENT PLUGS.—One manufacturer of screw-base plugs reports an increase of $5 per 1000 in lots of 10,000. Another manufacturer makes the following changes in discounts on all plug material: Standard package, from 35 per cent to 20 per cent; broken package, from 20 per cent to 5 per cent, and less than one-fifth standard package, from list to list plus 20 per cent.

WIRE.—Rubber-covered wire has been quoted on an average lower base of 1.2 cents. One manufacturer is on a 26-cent base, two on 25 cents, three on 24 cents, four on 23 cents, one on 22 cents, and one on cost.

FLUSH PLATES.—An increase of roughly 15 per cent is being quoted on one of the well-known lines.

BOSTON

Although the volume of trade reflects dull buying, a better feeling has been noted within the past week or two in jobbing circles. Inquiries are coming in rapidly, and not a few manufacturers' agents report that they are busier on quotation and delivery data than for many months. Collections are only "so so," though nothing serious is noted in the credit department of the trade. It seems likely that the extremely open winter may lead to earlier resumption of building operations than was expected. As yet nothing remotely resembling a boom in building can be discovered, but it is a fair guess that even present prices would be unable to prevent at least a moderate expansion in this direction now that war restrictions on materials are off. The United Electric Light Company of Springfield, Mass., is completing a six-hundred-thousand-dollar switch house built on the "cost-plus" plan; a new office building is to be erected at Westfield, Mass., and some new garage construction is planned for Boston soon. Jobbers are not buying much at present, but are keeping reasonably well stocked in anticipation of revived industry. Labor conditions are rather unsettled, and at this writing some danger of a strike of telephone employees is evident. A surplus of wiremen is reported. War contract cancellations have cut into central-station loads, and policies continue conservative. Deliveries are in good shape.

FARM-LIGHTING SETS.—The winter trade has hardly come up to expectations. Prices show little change, although one fifty-light set was recently marked down about $30 by a large farm machinery house owing to a weakening in battery prices. Gasoline engines hold firm in price, and a 10 per cent increase was recently announced in a popular make for general farm use. Dealers do not look for any very rapid drop in prices, and it is predicted that the next six months will show little change. Stocks are in good shape, and vigorous solicitation of new business is planned.

LAMPS.—A temporary shortage of 50-watt and 75-watt units is rapidly being overcome. Stocks are being built up well, despite the increasing use of light in displays. Sign lighting is picking up very fast.

WASHING MACHINES.—In some cases stocks are now ahead of the retail demand, although the latter is strong and prices appear to have little effect on the turnover.

VACUUM CLEANERS.—These are moving well, and a good year's business seems to be in realization. Stocks of cleaners reflect good production conditions in manufacturing plants.

ELECTRIC RADIATORS.—Jobbers and dealers are well supplied to meet the expected spring revival of demand. Sporadic price cutting has not upset the general market much as yet.

MOTORS.—Few orders are being placed at the moment, but inquiries are very numerous, and salesmen report distinctly better feeling among customers. The second-hand motor released from war duty has not affected prices to any extent. Stocks are in good condition up to about 75 hp. Trade is improving in smaller motors.

SCHEDULE MATERIAL.—Stocks are excellent and prices are firm. Distributers are well fortified against a real "drive." The demand is rather quiet, and few large jobs are being handled just now.

CONDUIT.—New England is now getting pipe on pretty satisfactory deliveries. The latest card increased the price to the contractor about 2½ per cent, the "spread" between the price to the jobber and his selling price being regarded as too small to cover handling charges. In the two weeks small wiring jobs have shown a tendency to increase.

ELECTRIC TRUCKS.—Interest is increasing in electric road trucks and pleasure cars. There will be a display of these at the Springfield (Mass.) Automobile Show, Feb. 24-March 1, as well as at the Hartford show, Feb. 22-March 1. Service results in Springfield will be featured as the basis of a real trade opportunity, and it is believed that the time has arrived to develop this business within its proper field as intensively as the gasoline automobile is being merchandised. Local distributers report an encouraging-looking market.

INDUSTRIAL ELECTRIC TRUCKS.—Inquiries are holding up well and manufacturers are planning on a good year. Even should labor costs fall to 1914 levels, which seems doubtful, these equipments will pay for themselves in many cases in a year or two of service. Increased attention is being given to adequate engineering supervision in industrial truck applications.

CHICAGO

The housing facilities of Chicago are rapidly becoming inadequate. Real estate is being purchased for building purposes, but the owners want lower prices in building materials before they break ground. The Morton Corporation of New York is having plans prepared for a fourteen-story, 400-room hotel to be erected at a cost of about $1,500,000. Contracts will probably be let in April. Horace and Thomas Dodge, automobile manufacturers, have offered to lend the city of Niles, Mich., their old home town, $1,000,000 for the building of houses to accommodate some 600 families, to be brought there when the division headquarters of the Michigan Central Railroad are moved from Michigan City to Niles.

As illustrative of the efforts of manufacturers to keep labor employed, the Pelton Steel Company of Milwaukee is using its regular employees to equip a new steel foundry which the company has taken over. The company has not sufficient business for its present foundry just now, but expects later on to need the increased capacity of the new foundry, and every effort is being made to keep the regular employees doing some sort of work until business picks up. It is felt here that the present labor problems of the country are responsible for the large stocks of finished material being piled up by the Steel Corporation and other large manufacturers.

Jobbers report that dealers until they are sure that copper has reached its bottom price will buy only for their immediate needs. Good business is expected from Illinois utilities because the State Public Utilities Commission has canceled, as of March 1, 1919, the war rule requiring customers to pay for line extensions. So many prospective central-station customers have been holding off, waiting for such a ruling, that it will take some of the companies a long time to get service to all the customers requiring free line extensions.

WIRE.—Rubber-covered wire base is narrowing down to 25 cents, though some is still sold at 27 cents.

CONDUIT.—Conduit is holding its own, and it is expected to continue firm on account of the present needs of the navy and the extensive naval program now contemplated.

ELECTRIC FANS.—Jobbers' stocks have not yet begun to move fast.

MOTORS.—Demand is light and deliveries are normal.

ATLANTA

Keen interest is manifested this week in the Southeast in shipping and shipbuilding industries. Details covering the formation of the South Atlantic Maritime Corporation have been made public. This corporation is composed of five South Atlantic ports, including Jacksonville, Savannah, Brunswick, Charleston and Wilmington. Extensive plans are under way to open up permanent trade lines with Central and South American ports. For a time it was thought that the building of wooden ships would be abandoned, but information from reliable sources indicates that both the Shipping Board and private plants will resume construction on a larger scale. Although the yards are comparatively quiet at present, plans on foot will create a demand for all classes of materials as great as previously experienced. The feeling that prevails at coastal cities is very optimistic and jobbers are beginning to realize the future possibilities of this trade. A large cement plant is contemplated at Demopolis, Ala.

Trade in general is about the same as last week. A few lines such as automobile accessories are highly active. The demand for horns exceeds the present supply and shipments are improving slowly. Independent telephone companies are increasing their purchases at the price levels now prevailing.

SCHEDULE MATERIAL.—The call for all types of porcelains continues fairly steady, and a satisfactory volume of orders is being recorded for sockets. Knife switches and associated lines are moving freely and there is very little change in the demand that carried over from 1918. All transactions are based on the market and no change in price has been noted.

CABLE.—Immediate spotty requirements have brought a slight activity, but the demand will have to increase considerably before a volume of business equivalent to that for the latter months of 1918 will be transacted. Lead-covered telephone cable is off approximately 10 per cent. Freer deliveries are noted, and factory shipments have been brought down to ten days to three weeks.

LINEMEN'S APPLIANCES.—Jobbers report no let-up in the demand for tools and other apparatus; in fact, stocks are below normal and great difficulty is experienced in taking care of current needs. Factory facilities are rapidly being changed to meet commercial requirements. Prices remain firm.

INSULATORS.—Activity has lessened, but it is expected that the spring will see a resumption of buying for maintenance. Prices are holding up remarkably well and shipments are good.

CONDUIT.—The lull in trade is tending to bring stocks back to normal conditions, and last week's scarcity in certain sizes has almost vanished. A further price reduction is looked for.

POLES.—Sales have sagged off, and the present volume is sustained by independent telephone activity and increased purchases from the smaller central stations. Cedar stocks are piling up and immediate deliveries are being promised. In the face of stock surplus and lessening demand, prices have not changed.

HARDWARE.—Orders are less frequent and call for smaller quantities. This condition has no doubt resulted in bringing about the perceptible weakening in prices noted this week. Local deliveries have improved, stocks are accumulating, and factory shipments are coming through much more quickly

SEATTLE—PORTLAND

Electrical jobbing business in both Seattle and Tacoma has been virtually at a standstill owing to the strike. The volume of business since the end of the general strike is considerably improved but is still at a very low ebb. Large houses during the strike, when street railways and trucking were tied up, shipped all large orders from out-of-tow branches. Retailers have suffered heavily since the beginning of the strike difficulties on Jan. 21. During the general strike business was at an absolute standstill.

In Seattle stocks of both jobbers and dealers are reported to be in good shape. Shipments are coming through in a fairly satisfactory way, and no change in prices is noted. Steel and wooden shipyard owners and contract shops announce opening of yards and shops and resumption of shipbuilding on Feb. 19 at scale of wages in effect Jan. 21. In Seattle electrical jobbers predict within two months that independent telephone, rural power companies and prospective builders will begin buying. Since America entered the war this trade has bought for maintenance purposes only. Several power companies already have tentatively announced plans for early constructional activities, including extensions and additions.

The Portland district states that manufacturers report business during January exceeded expectations, although it did not equal that for January last year. Stock movement does not seem to be especially pronounced in any one line, but is quite general in nature. No particular large sales have been reported recently. A number of new enterprises are being seriously considered, and if these are carried out, they will require an appreciable amount of power and light equipment. Owing to the fact that manufacturers refuse to cancel orders received from their distributing agencies in the Portland district, and also to the fact that sales have been less than they were a year ago, agencies find their stocks rapidly filling up, so that they will be in good condition to care for increased business expected to develop.

SAN FRANCISCO

Although the past week's business has not been much of an improvement, still there are more hopeful signs for the future. Most building materials, such as lumber, which has been reduced 20 per cent, have decreased in value, and there have also been big decreases in standard electrical wiring material, so that it is possible that some of the urgently needed private buildings will be actually under way soon. Another encouraging feature has been some very heavy showers, which thoroughly saturated the state as far south as Fresno. Furthermore, this rain was accompanied by a snowfall on the higher Sierras that actually doubled the quantity of snow on the ground. As the prosperity of the state depends principally upon its natural products, the merchants as well as the farmers are very optimistic concerning the result of the season.

On the other hand, the labor situation is badly demoralized in the Oakland ship plants. In defiance of the orders of the leader of the boilermakers' union, the Oakland boilermakers have struck, and the immediate result has been the cancellation of $10,000,000 worth of orders for the United States government. San Francisco unions have opposed any such action, and the San Francisco labor situation is very healthy at this time.

San Francisco commercial societies are laying broad plans for additional overseas trade. For several years past traveling conditions to the Orient have been uncertain and passage difficult to secure on account of the lack of ships. The Japanese line has recently voted the construction of two 25,000-ton liners, which will be the biggest ships seen in the Pacific since the ill-fated Hill freighters. The following January, 1919, building permits are reported: Los Angeles, 649 permits, value $813,000; San Francisco, 253 permits, value $493,000; Oakland, 187 permits, value $261,000.

RANGES.—Jobbers report a number of range inquiries from central stations regarding cost and deliveries, so that they can stage several sales or assist local dealers. There are big local stocks at the present time, and the manufacturers promise quick deliveries. In regard to the mooted question of prices, a definite and official notice has been sent out to the trade by the president of a group of range manufacturers, stating that there will be no decrease in costs before April 1, and as far as can be ascertained at the present time there will be none until the latter part of the year.

WEATHERPROOF WIRE.—The Pacific Coast price on base sizes of weatherproof wire in coil lots is now $28 per 100 lb., it having gone down in one jump from $37 per 100 lb.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTOR, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

Twin-Conductor

	No. 14 Solid
Less than coil	List
Coil to 1000 ft	10%
	No. 12 Solid
Less than coil	List
Coil to 1000 ft	10%

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+20%
Coil to 1000 ft	List
	No. 12 Solid
Less than coil	+20%
Coil to 1000 ft	List

Twin-Conductor

	No. 14 Solid
Less than coil	$115.00
Coil to 1000 ft	100.00
	No. 12 Solid
Less than coil	+20%
Coil to 1000 ft	List

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each.
Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	+20%
1/5 to std. pkg	List
Std. pkg	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+30% to List
1/5 to std. pkg	+5% to 20%
Std. pkg	18% to 36%

BATTERIES, DRY
NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45—$0.46	$0.45—$0.47
12 to 50	.40	.40— .41
50 to barrel	.35— .36	.36— .37
Barrel lots	.32— .329	.33— .339

BATTERIES, DRY—Continued
CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.45	$0.45
12 to 50	.38	.38 to $0.39
50 to barrel	.35 to $0.362	.35 to .372
Barrel lots	.326 to .332	.326 to .342

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List per 100 Ft.
⅛	250	$5.00
¼	250	7.50
⅜	100	10.00
½	50	13.00
1	50	21.00
1¼	50	26.00
1½	25–50	35.00
2	25–50	45.00
2½	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less than Coil	Coil to 1000 Ft.
⅜-in. single trip	$75.00	$63.75— 69.75
⅜-in. double strip	75.00— 82.50	72.00— 75.00
½-in. single strip	100.00	85.00— 93.00
½-in. double strip	100.00—110.00	96.00—100.00

NET PER 1000 FT.—CHICAGO

	Less than Coil	Coil to 1000 Ft.
⅜-in. single strip	$75.00	$63.25 to $63.75
⅜-in. double strip	78.25 to $78.75	71.25
½-in. single strip	100.00	75.00 to 85.00
½-in. double strip	105.00	93.00 to 95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List per Foot	Size, In.	List per Foot
⅛	$0.05½	1	$0.25
¼	.06	1¼	.33
⅜	.09	1½	.40
½	.12	1¾	.47
⅝	.15	2	.55
¾	.18	2½	.65

NET PER 1000 FT.—NEW YORK

	Less than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	$25.00–50.70	$24.00–35.20	$23.00–30.25
½-in.—	30.00–56.40	28.00–38.40	26.00–33.00

NET PER 1000 FT.—CHICAGO

	Less than $15 List	$15 to $60 List	$60 to $150 List
⅜-in.—	$60.00	$30.00	$26.00–26.50
½-in.—	65.00	32.00–32.50	29.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 40

Size, In.	Conduit, List per Foot
⅛	$0.08½
¼	.08½
⅜	.08½
½	.11½
¾	.17
1	.23
1¼	.27½
1½	.37½
2	.58½
2½	.76½
3	

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON—Continued

Size, In.	Couplings, List	Elbows, List
⅛	$0.05	$0.19
¼	.06	.19
⅜	.07	.19
½	.10	.25
¾	.13	.37
1	.17	.45
1¼	.21	.50
1½	.28	1.10
2	.40	1.80
2½	.60	4.80
3		

DISCOUNT—NEW YORK

	¼ in. to ½ in.	¾ in. to 3 in.
Less than 2500 lb.	7% to 7.1%	9% to 9.1%
2500 to 5000 lb.	10% to 10.1%	12% to 12.1%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	¼ to ½ In.	¾ to 3 In.
Less than 2500 lb.	+3%	+1% to 2%
2500 to 5000 lb.	+1% to 2%	+4%

(For galvanized deduct six points from above discounts.)

FLATIRONS
NEW YORK

List price	$6.50 to $7.00
Discount	20% to 25%

CHICAGO

List price	$6.35 to $7.50
Discount	20% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp	100	$0.25
35-amp. to 60-amp	100	.35
65-amp. to 100-amp	50	.90
110-amp. to 200-amp	25	2.00
225-amp. to 400-amp	25	3.60
450-amp. to 600-amp	10	5.50
600-Volt		
3-amp. to 30-amp	100	$0.40
35-amp. to 60-amp	100	.60
65-amp. to 100-amp	50	1.50
110-amp. to 200-amp	25	2.50
225-amp. to 400-amp	25	5.50
450-amp. to 600-amp	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	30%
1/5 to std. pkg	41%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	30%
1/5 to std. pkg	40% to 41%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg	$6.00 to $8.75
1/5 to std. pkg	5.50 to 7.00

Standard packages, 500. List, each, $0.07

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg	$8.00
1/5 to std. pkg	7.00

Standard packages, 500. List each, $0.07

LAMPS, MAZDA OR TUNGSTEN

110 to 125 Volts

Regular, Clear:	Std. Pkg.	List Each
10 to 40-watt—B	100	$0.35
60-watt—B	100	.40
100-watt—B	24	.85
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round Bulbs, 3½-in., Frosted		
15-watt—G 25	50	.60
25-watt—G 25	50	.60
40-watt—G 25	50	.60
Round Bulbs, 3½-in., Frosted:		
60-watt—G 30	24	.82
Round Bulbs, 4½-in., Frosted:		
100-watt—G 35	24	1.15

DISCOUNT—NEW YORK

Less than std. pkg.	List
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	List
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$32.18—$40.77
Coil to 1000 ft.	28.60— 32.98

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$32.00—$36.00
Coil to 1000 ft.	25.00— 27.00

LAMP GUARDS, WIRE

Standard packages from 50 to 150

NEW YORK

Net per 100	$33.00

CHICAGO

Net per 100	$33.00

OUTLET BOXES

Nos.	List per 100
101—A, A 1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200, S.E., 300, A.X., 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S., 1½, 3 R	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	26%	20%
$10.00 to $50.00 list	36%	31%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	20%–32%	10%–27%
$10.00 to $50.00 list	30%–40%	20%–35%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	5%
1/5 to std. pkg.	15%
Std. pkg.	25%

PORCELAIN CLEATS—UNGLAZED

Two and Three Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$20.00 to $21.00
1/5 to std. pkg.	17.00 to 17.85
Standard package, 2200. List per 1000, $21 to $34	

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$21.00–$24.15
1/5 to std. pkg.	17.85– 21.00
Standard package, 2200. List per 1000,	$20.00

PORCELAIN KNOBS

NEW YORK

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$16.00	$26.00
1/5 to std. pkg.	13.60	21.20

CHICAGO

Per 1000 Net.	Std. Pkg. 3500.	Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C.
Less than 1/5 std. pkg.	$13.00–$18.40	$32.00–$36.80
1/5 to std. pkg.	11.50– 16.00	27.20– 32.00

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
½-in. cap key and push sockets	500	$0.33
½-in. cap keyless socket	500	.30
½-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	List
1/5 std. pkg.	List to 10%

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-qmp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	$0.42
60-amp. S. P. S. T.	.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	+15% to +10%
$10 to $25 list	+10% to 2%
$25 to $50 list	5%
	Low Grade
Less than $10 list	+5% to list
$10 to $25 list	List to 8%
$25 to $50 list	15%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+25%+15%
$10 to $25 list	+10% to 2%
$25 to $50 list	+5% to 5%
	Low Grade
Less than $10 list	+15% to +5%
$10 to $25 list	2% to 8%
$25 to $50 list	5% to 15%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

10-Amp., 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

SWITCHES, SNAP AND FLUSH—Continued

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	+20%
1/5 to std. pkg.	List
Std. pkg.	15% to 17%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+30% to list
1/5 to std. pkg.	+5% to 10%
Std. pkg.	8% to 18%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	Net to 18%	Net
$2.00 to $10.00 list	10% to 28%	5%
$10.00 to $50.00 list	20% to 45%	10%

DISCOUNT—CHICAGO

	Galvanized	Black
Less than $2.00 list	25% to 40%	20% to 30%
$2.00 to $10.00 list	25% to 50%	20% to 40%
$10.00 to $50.00 list	25% to 64%	20% to 52%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00 to $6.50
Discount	20% to 25%

CHICAGO

List price	$6.35 to $7.00
Discount	20% to 30%

WIRE, ANNUNCIATOR

NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.46–$0.66
No. 18, full spools	.44– .56

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.60 to $0.90
No. 18, full spools	.53 to .64

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
14	$15.00–$25.00	$11.00–$17.00	$11.00–$15.00
12	21.40– 27.09	19.26– 23.22	16.05– 23.22
10	28.94– 32.40	26.06– 32.40	20.83– 27.45
8	35.82– 45.72	32.84– 45.72	28.66– 38.10
6	56.70– 72.36	51.98– 60.30	45.36– 57.88

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14	$19.50–$20.00	$14.50–$15.00	$13.00–$14.50
12	17.50– 24.57	17.55– 24.57	17.55– 21.06
10	24.05– 32.97	24.05– 32.97	21.16– 28.26
8	33.35– 46.69	33.35– 46.69	29.35– 40.02
6	52.95– 73.71	46.60– 63.18	46.60– 52.65

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 3 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$29.75 to $34.75
25 to 50 lb.	29.75 to 34.75
50 to 100 lb.	28.75 to 33.75

CHICAGO

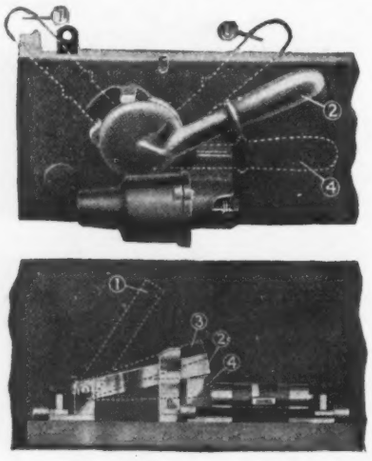
	Per 100 Lb. Net
Less than 25 lb.	$32.75 to $35.75
25 to 50 lb.	31.75 to 34.75
50 to 100 lb	30.75 to 37.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Externally Operated Motor-Starting Switches

Recent additions to the products of the Trumbull Electric Manufacturing Company of Plainville, Conn., are its externally operated motor-starting



MOVEMENT FROM "OFF" TO "RUNNING" POSITION; 1, "OFF"; 2, "START"; 3, "RELEASE"; 4, "RUN"

switches of the "straight-through" type furnished with either hand release or an under-voltage release coil. These switches have the safety features common to others made by this company since the box cannot be opened until the switch is in the "off" position and a catch prevents the switch from being closed with the box cover open. Hence, with fuses and blades always "dead" whenever the switch is exposed, shock and fire hazards are eliminated.

In using the new-type switches the operator throws the handle forward until it comes to a dead stop in the first or no-fuse starting contacts. When speed is up he draws the handle slightly back, about 15 deg., but not out of contact, until the plunger is released and then throws the switch forward into the second or fused running contacts. In this way the contact is never broken because the switch passes directly through starting into running contacts, and as the switch does not leave the starting contacts until it enters the running contacts there is no arc at this stage of operation. In addition, there is no arc from the running contacts when the switch is opened, since the running contacts are not used to break the current.

By pushing the button of the plunger in the under-voltage release coil the switch is automatically thrown into the "off" position. A catch kept in place by the current holds the switch in the running contacts, and when the power is off or the voltage materially reduced the switch is automatically thrown into the "off" position. When the hand release is used merely pressing the lever automatically throws the switch into the "off" position.

Loom Fastener

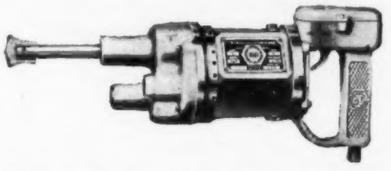
An improved-type flexible-tubing bushing for keeping the loom in position in an outlet box has recently been placed on the market by the K-B Manufacturing Company, 287 Second Street, San Francisco, Cal. It is shaped like an Egyptian scarab with a transverse groove on its back to engage the wall of the outlet box. The tapered ends of the fastener hold the tubing on one side while the opposite side rests against the wall. Not only is the con-

METHOD OF ATTACHMENT

nection made through the use of this device between the loom and the outlet box permanently secure, but the manufacturer also points out the simplicity of applying the bushing. The insertion of the tubing and the fastener in a "knock-out" is done from any convenient angle, and by bringing the tubing to a position at right angles to the wall of the box the fastener snaps into a positive and permanent locking grip. In this way no tinkering is necessary, the locking snap of the fastener proving that it is holding the loom to the best of its ability. There are no prongs present to injure the tubing, whose circular form is also retained, since the fastener grips the loom at three isolated points. The fastener is made to withstand a large amount of abuse in a wireman's kit or elsewhere without suffering injury.

Valve Grinder with Pistol Grip and Trigger Switch

To supplant the old laborious method of grinding valves by hand the Black & Decker Manufacturing Company of



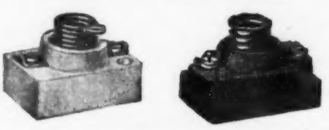
DIFFERENT TYPE VALVES MAY BE GROUND

Baltimore, Md., has recently developed an electrically driven valve grinder. The spindle of the new device is said to oscillate with a long steady sweep similar to the movement obtained in hand grinding but many times more rapid. The pistol grip and trigger switch are employed and make it possible to operate and control the grinder in a very convenient manner. An air-cooled ⅓-hp. motor is used and operates on standard circuits of either alternating current with a range of 25 to 60 cycles or direct current, being made for 110, 220 and 32-volt circuits.

The motor and gearing, together with the reciprocating mechanism, are completely inclosed in an aluminum housing, the gearing and oscillating movement being separated from the motor compartment and packed in grease. The grinding spindle runs in a ball thrust bearing, the armature shaft runs on Norma ball bearings, while the gears are mounted on shafts ground to size and supported at both ends in long phosphor-bronze bushings. The tool is adaptable to various types of valves, bits for this purpose being provided.

Candelabra Cleat Receptacles

The wiring devices made by the Bryant Electric Company of Bridgeport, Conn., have recently been sup-



VIBRATION DOES NOT LOOSEN THE BULB FROM THE CONTACTS

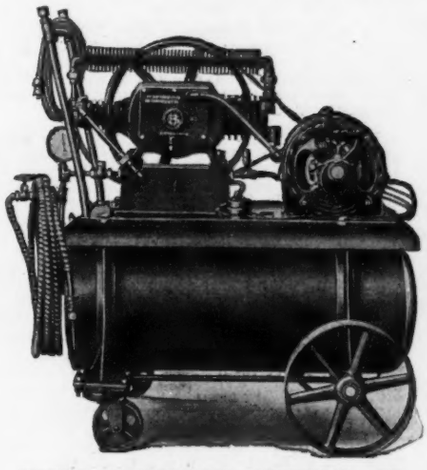
plemented by new candelabra cleat receptacles which conform to National Electrical Code standards. They are made with a regular spun-copper screw shell and also with a shell of spring

wire which expands as the lamp base is threaded into it. The tension of this spring wire is stated to be more than sufficient to prevent the lamp becoming loosened when subjected to great vibration and jar. The base of the block is made of high-grade molded composition of the character approved by the United States Navy and is said to be amply strong to withstand very severe service. The new receptacle is applicable for use where it is necessary to illuminate instruments in the cabs of railroad locomotives, on board vessels, etc.

Two-Stage Portable Air Compressor Outfit

Many uses for the new "Usaco" two-stage portable air-compressor outfit are mentioned by the maker, the United States Air Compressor Company, Cleveland, Ohio. Dust and oil which accumulate in electrical machinery, and which if neglected may cause short-circuiting, can be cleaned from machines by this compressor more quickly and thoroughly than by hand cleaning with rags and bellows. The device is also adapted to clean textile or other machinery with delicate parts, where dust, lint or grit impairs efficiency and hastens deterioration. The outfits are also useful in removing soot from tubes of heating boilers and for various other services requiring high-pressure air.

The compressor is self-oiling and is furnished with a balanced check valve to prevent air leakage, a filtering trap and a safety valve as well as a reducing valve. It is mounted on a metal base and is belt-driven by a motor for any current. An idler and belt tightener are installed, and further adjust



USEFUL IN CLEANING ELECTRICAL AND OTHER MACHINERY

ment can be secured by turning a screw which moves the motor along the slotted base. Motors for alternating current are equipped with a pressure release, permitting them to start against no pressure and thus eliminating any possibility of burned-out motors or fuses. A 20-gal. (76-l.) tank, equipped with wheels, supports the rest of the machinery, which also includes 25 ft. (7.6 m.) of armored hose, a push-button air nozzle, a pressure gage, a needle valve, 15 ft. (0.46 m.) of electric cable, a switch and a plug.

This outfit, it is said, will operate continuously against 100 lb. (7 kg.) pressure without overheating. The tank regularly furnished is tested to 200 lb. (14 kg.) working pressure, but tanks for higher pressures can be supplied. The tank capacity of this machine is said to be sufficient to store air from fifteen to thirty minutes, depending upon the size of nozzle used and the pressure delivered. A regulating valve permits a tank pressure of from 150 lb. to 200 lb. (10.5 kg. to 14 kg.) to be delivered at the nozzle by simply turning the adjusting screw. An automatic control can be furnished with this outfit if desired so that the compressor is started and stopped automatically, maintaining the tank pressure at the desired point.

Dry-Type Glue Pots

A number of advantages and points of improvement are claimed for the new dry-type electrically heated glue pots made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., over other ways of heating

NO ENERGY WASTED IN HEATING WATER BATH

glue. There is no water bath in the new pots and consequently no water to evaporate and cause the heater to burn out and the glue to burn. The dry type having a single-heat constant input heater, there is no necessity for two heats, "high" and "running," since the temperature is the same for continuous operation. No energy is required to heat a water bath before the glue is heated, resulting in more economical operation. Time is also saved since the glue is heated directly without heating a water bath first. In addition, the advantage of eliminating the inconvenience and sloppiness attending a water bath which has to be constantly added to is pointed out.

These new dry-type pots are made in three sizes, 1-pt. (0.47-l), 1-qt. (0.9-l.) and 4-qt. (3.8-l.) and are rated respectively at 60, 80 and 140 watts. The spun-copper glue vessel fits snugly into the sheet-steel bottom plates so as to make proper thermal contact with the heating element, which is an integral part of the sheet-steel bottom plates. Underneath the heater is placed an extra steel plate with a dead-air space between to keep the heat generated in the heating element from being conducted downward from the pot. The heater itself is said to maintain the glue at the correct working temperature when the pot is being operated continuously. Consequently whether the glue is being used or not, no danger of overheating is present. Fifteen minutes is the approximate time taken to bring the glue to the proper temperature for use. These dry-type pots are supplied with cord and plug for connection to a lamp socket.

Locking Lamp Guards for Reflectors

A new line of locking lamp guards for use with reflectors is about to be placed on the market by Harvey Hubbell, Inc., Bridgeport, Conn. As shown in the accompanying illustrations, they are radically different in design from the other types made by this company,

GUARD ATTACHED TO A STEEL REFLECTOR

but are said to possess the same rugged strength due to the strong steel wires and electrically welded joints. The locking device, operated by a special key, draws the guard tight around the reflector, making the two parts practically one unit and insuring the protection of the lamp against both breakage and theft. These guards can be readily adapted to slight variations in reflector sizes.

Recent Appliances

Lighting Unit

The Bullock Manufacturing Company with offices at 408 West Thirteenth Street, New York City, has placed on the market a dust-proof lighting fixture with a diffusing bowl of daylight glass.

Vacuum Cleaner with Comb

A positive suction cleaner made in two sizes, one having a larger nozzle than the other, and which uses a special comb instead of a revolving brush, has been placed on the market by the Maytag Company of Newton, Iowa.

Trade Notes

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An electrical engineer in France (No. 28,357) desires to purchase large quantities of electrical accessories and requests quotations on these goods. Correspondence may be in English.

A firm in Denmark (No. 28,320) desires to purchase and also secure an agency for the sale of electric motors of 220 volts and 110 volts, direct and alternating current and electric bulbs. Quotations should be made f.o.b. New York. Terms cash. Correspondence may be in English.

A company in India (No. 28,335) desires to purchase and to obtain an agency for the sale of electrical goods.

A man in France (No. 28,345) wishes to secure agencies for the sale of railway materials and electrical apparatus. Correspondence should be in French.

A man in Italy (No. 28,316) desires to secure an agency for the sale of electrical materials. Correspondence in Italian.

A firm in Australia (No. 28,287) wants agencies in a number of lines including electrical sundries.

An electrical supply firm in Belgium (No. 28,290) desires to be placed in communication with firms for the purchase of electrical appliances, electrical machines, machine tools worked by electricity, insulating material, conductive wire, lamps, glassware, etc. Catalogs and price lists are requested. Correspondence should be in French.

A firm in Belgium (No. 28,294) wishes to be placed in touch with manufacturers of electrical material.

A wholesale dealer in France (No. 28,296) desires to secure an agency for the sale of electric motors and supplies. Correspondence may be in English.

A man in Norway (No. 28,297) desires to purchase or secure an agency for the sale of copper wire and cable. Correspondence may be in English.

An agency is desired by a firm in Switzerland (No. 28,303) for the sale of motors, telephone apparatus, high-tension equipment and insulators. Correspondence should be in French or Italian.

A man in Norway (No. 28,305) desires to purchase electrical apparatus and supplies, light, heat and power service, lead, and steel and copper wire and cable. Terms, cash against documents at destination. Correspondence may be in English.

Alexander Smith, Ltd., Bulletin Place, Sydney, Australia, wishes to enter into correspondence with American manufacturers of electrical apparatus and electrical household appliances with a view to securing representation in Sydney for up-to-date lines.

James J. Niven & Company, Ltd., Wellington, New Zealand, P. O. Box 579, wants to secure sole New Zealand representation for an American line of electric motors.

BRITISH STORAGE BATTERY CONSOLIDATION.—The New Peto & Radford Accumulator Company and the Pritchett & Gold and Electrical Power Storage Company, Ltd., have amalgamated interests. These firms, which have been prominent in the British manufacture of storage batteries for some time, expect a largely increased business.

POLISH COMMERCIAL BUREAU.—There was opened on Jan. 1 the Commercial and Industrial Bureau of the Polish National Department with the object of helping to start commercial connections between the United States and Poland and of collecting all data and information which should form a basis for the work of the future official Polish commercial agencies in the United States and facilitate mutual economic relations. The bureau will be glad to send any information concerning trade conditions and business possibilities in Poland.

ITALIAN GOVERNMENT SPECIFICATIONS FOR ELECTRICAL MACHINERY.—The Italian *Gazetta Ufficialle* for Dec. 12, 1918, according to Trade Commissioner O. M. Smart, published a decree announcing that the standards of the Italian Electrotechnical Association for 1916 will be followed in the specifications of electrical machinery for the government. The regulations are printed in detail and include conventional signs, terms, definitions and instructions for bidding on government work.

A. E. G. REPORT.—The report of the Allgemeine Elektrizitäts-Gesellschaft of Germany for the financial year of 1917-18, as noted in the London *Electrical Review*, states that the company, although working on government orders, at the same time had preparations made for work on peace manufactures in the ordinary departments, and in this connection it was frequently possible, with lasting advantage, to meet the scarcity of materials by the use of substitutes. The report stated that the organization in Germany and in those foreign countries which could be reached had worked satisfactorily, and no ousting of the company's manufactures from accessible markets had anywhere taken place.

LARGE BRITISH MANUFACTURING CONCERN TO EXPAND.—At the annual meeting of the Edison Swan Electric Company, Ltd., of England it was stated that the board of directors had in view a general policy of expansion, feeling as it did that in the near future, if the company intends to hold its own, it must be in a position to supply direct from its own factory every class of electrical material from the smallest to the largest. To do this a bid for capital is going to be issued at an early date. In connection with the scheme of expansion at that time the company had practically concluded negotiations for obtaining a large interest in a well-known and old-established firm of cable and electrical wire manufacturers. Negotiations also are being carried on which, it is stated, if successful, will give the company an important interest in the manufacture of all classes of heavy electrical machinery.

NEW ENGLAND WILLARD STORAGE BATTERY CONVENTION.—Sixty New England service station representatives of the Willard Storage Battery Company convened at Lorimer Hall, Boston, on Feb. 11 and 12. The convention is the second of fifteen which are being held in all parts of the country in the period from Feb. 6 to April 8 inclusive, trade and service topics forming the chief subjects of discussion. The Boston program of the opening day included the following events: Registration; address, "How Is Your Gravity?" by Hobart A. Adams, district manager, New York City; "Taking an Inventory of Ourselves; Our Responsibility to the Public; What Should We Do in the Future?" by W. W. Wyneken, sales manager, Cleveland, Ohio; "The Personal Element in Business," by H. S. Bentley, manager of sales promotion, Cleveland; the Willard film, "Opportunity," and an open discussion by service-station owners and managers on "Making Satisfied Customers," and "How to Avoid Lost Sales." The second day opened with a discussion on "How to Get Dealers' Cooperation," "When to Repair" and "The Still Better Willard Battery," which was scheduled to occupy practically the entire morning. The afternoon session was planned to include a motion-picture trip through the Willard factory, an address, "Facts and Figures in a Willard Service Station," by W. W. Wyneken, and a closing reel entitled "Through Service We Grow." Mealtime announcements on the program made a hit from the battery man's standpoint as follows: "Recharge," "Free Testing and Filling Service," and "Inspection of Plates." The first convention was held at Cleveland Feb. 6 and 7, and dates assigned for the succeeding meetings were: New York City, Feb. 13-14; Detroit, Feb. 17-18; Chicago, Feb. 20-21; Indianapolis, Feb. 24-25; Atlanta, Feb. 27-28; Dallas, March 3-4; Kansas City, March 6-7; Denver, March 11-12; Los Angeles, March 17-18; San Francisco, March 20-21; Portland, Ore., March 25-26; Butte, March 31-April 1; Minneapolis, April 7-8.

THE SQUARE D COMPANY has removed its San Francisco offices to 324 Rialto Building.

W. S. ECKART has been elected vice-president in charge of sales of the National Conduit & Cable Company.

THE EMERSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., announces that three-phase motors of 1-hp. and 2-hp. sizes for 110 volts and 220 volts, 60 cycles, are now carried regularly in stock.

THE CANADA WIRE & CABLE COMPANY, LTD., Toronto, it is reported, will exhibit at the Lyons, (France) fair, to be held in March next.

THE BLAW-KNOX COMPANY announces that its San Francisco office has been removed from its warehouse at 528 Second Street to 630 Monadnock Building.

F. M. HIBBEN has resigned from the Cleveland Electric Illuminating Company after eleven years of service to become vice-president of the Cleveland Armature Works.

THE LEWIS ELECTRICAL SUPPLY COMPANY, Boston, announces that John B. Ward, formerly manager of the company, terminated his connection with it on Feb. 3.

ANDERSON PACE has been appointed director of advertising of the Mercury Manufacturing Company, Chicago, manufacturer of electric industrial tractors, effective Feb. 15.

H. BOKER & COMPANY, 101 Duane Street, New York City, who have been importing a line of Italian fans, motors, dynamos, etc., since 1916, are liquidating their electrical department.

THE UNITED ELECTRIC SUPPLY COMPANY, Boston, writes that it intends to continue and intensify its selling campaign during the current year, which it has every reason to believe will be its banner year.

DANIEL J. GILBERT has been appointed Eastern sales representative of the Fafnir Bearing Company, New Britain, Conn. Mr. Gilbert was previously superintendent of the grinding department of the company.

S. P. RUSSELL has resigned as manager of the electrical department of the H. W. Johns-Manville Company of San Francisco and purchased an interest in the firm of H. B. Squires, manufacturers' agent, San Francisco.

THE FRED W. L. FULLERTON COMPANY, INC., and the Fullerton Electric Company, electrical merchandisers, have removed from 21 East Twenty-second Street to larger space at 15 West Twentieth Street, New York City.

THE EPPING-CARPENTER PUMP COMPANY, Pittsburgh, Pa., announces that Theodore R. Hermanson, formerly of the Harrison Works of the Worthington Machinery Corporation, has become associated with it as works manager.

WARREN WEBSTER & COMPANY, manufacturers of power-plant specialties, Camden, N. J., announce the opening of their Texas office at 805 Sumpter Building, Dallas, Tex., with W. B. Irwin in charge as district representative.

F. A. PUTT, formerly with the General Electric Company and the Clyde Iron Works, is now department manager for Edward Jobbins, Marquette Building, Chicago, where he handles railway, power and contractors' equipment and supplies.

DR. MILTON W. FRANKLIN, for several years consulting engineer for E. P. Houghton & Company, Philadelphia, has resigned to become associated with the Remy Electric Company of Anderson, Ind. On Jan. 21 Dr. Franklin was given a farewell dinner by his associates in Philadelphia.

THE CHANDEYSSON ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., is now completing its factory buildings, which will be equipped to produce motors and generators. This company's product, it is reported, has been manufactured by the Pan Electric Manufacturing Company under license.

THE DUPLEX LIGHTING WORKS OF THE GENERAL ELECTRIC COMPANY have established headquarters for "Duplexalite" at 6 West Forty-eighth Street, New York City, with Rex J. Cole as manager. This organization specializes in a line of light-diffusing units which can be used with Mazda C lamps only.

H. H. SKINNER, formerly of the power engineering bureau of the sales department of the Narragansett Electric Lighting Company, Providence, R. I., is now representing the Westinghouse Electric & Manufacturing Company in Rhode Island and eastern Connecticut. Mr. Skinner is well known in the New England central-station field. He was at one time actively identified with electric vehicle development on behalf of the Narragansett company. His headquarters are in the Union Trust Building, Providence.

THE MANHATTAN ELECTRICAL SUPPLY COMPANY, INC., New York City, showed an increase in gross sales last year of about 6½ per cent. The gross sales for 1918 were $5,836,632 and for 1917 $5,483,472.

THE ISCO MANUFACTURING COMPANY, manufacturer of refrigerating machinery including electrical refrigerators, is about to remove its business from Detroit to Chicago, where it has leased 60,000 sq.ft. of floor space in a building on the northeast corner of Clybourn Avenue and Terra Cotta Place.

THE EDISON ELECTRIC APPLIANCE COMPANY, Chicago, has announced plans for a large expenditure in publicity for the current year. Orders have been placed for space in national magazines and weeklies of largest circulation. The advertisements, it is stated, will appear in more than 18,000,000 copies of these publications.

THE CROUSE-HINDS COMPANY is now represented on the Pacific Coast by F. A. Gerhart, with headquarters at San Francisco. Mr. Gerhart succeeds George A. Gray, who resigned from the company after nine years' service. Mr. Gray has started a manufacturers' agency in the Sheldon Building, San Francisco, where he expects to represent electrical manufacturers.

VALENTINE J. BURGER, D.S.C., first lieutenant, aviator observer with the French and American air forces, has recently returned to the Standard Underground Cable Company, where he resumes charge as the New York manager of exports. He was the guest of honor at a presentation

FIRST LIEUT. V. J. BURGER

luncheon tendered by the New York officers of the company on Feb. 13 at the Railway Club. C. J. Marsh, vice-president of the Standard Underground, acted as chairman, and with him were T. L. Wiley, Eastern manager, R. S. Hopkins, assistant Eastern manager, and other members of the New York construction, sales and office force. Lieut. Burger received the distinguished service cross, the French croix de guerre with palm and star, and is cited for oak leaf to the D. S. C., another palm to the French cross and for the Congressional medal of honor. He rendered repeatedly distinguished service under great personal danger and has been officially credited with three Boche planes.

LE ROY SCOTT, formerly engaged in sales promotion work for the storage-battery division of the National Carbon Company, Cleveland, Ohio, is now acting as consulting engineer for the storage-battery department of the company's San Francisco office and as manager of the electrical and battery department of the company in Los Angeles, Cal.

PAUL CAMPBELL has been appointed factory manager of the Electric Service Supplies Company of Philadelphia. Through the greater part of 1918 Mr. Campbell was connected with the New York district office of the Bureau of Aircraft Production as a special investigator of production problems in the New England States, previously having been production manager for James Cunningham, Son & Company, Rochester, N. Y., and superintendent of the F. B. Stearns Company, Cleveland, Ohio.

H. G. STEWART, who was formerly with the engineering firm of Sargent & Lundy, Chicago, has joined the sales forces of the Electro Magnetic Tool Company, 2902 Carroll Avenue, that city.

JAMES N. HATCH, consulting engineer, Chicago, has formed an association with Henry C. Eckland, formerly Eckland, Fagard & Knapp, as Henry C. Eckland & Company, architects and engineers. Mr. Hatch, however, will continue his consulting practice of public utility and industrial engineering as heretofore.

BROWN, HANSON & BOETTCHER were dissolved Dec. 31, 1918. Charles A. Brown, Arthur H. Boettcher and John A Dienner continue the practice of patent, trademark and copyright law at 1550 Monadnock Block, Chicago, under the firm name of Brown, Boettcher & Dienner. Brown, Boettcher & Dienner will also continue the Milwaukee office at 1136 Wells Building.

THE POWDERED COAL ENGINEERING & EQUIPMENT COMPANY, Chicago, announces that John F. Nealis and Lester E. Armstrong have become associated with the company as advisory engineers. Mr. Nealis was formerly in charge of research work for the United States Steel Corporation, and Mr. Armstrong was associated with Babcock & Wilcox. Both men have been in the Air Service.

Trade Publications

VALVE GRINDERS.—The B. F. S. Manufacturing Company, Worcester, Mass., is distributing a circular on its heavy-duty and "baby" electric valve grinders.

COMPRESSOR.—Bulletin No. 119, which has for its subject the various models of air compressors made by the Globe Manufacturing Company of Battle Creek, Mich., has been distributed by that company.

INDUSTRIAL TRUCKS.—The Industrial Truck Company, division of the Cowan Truck Company, Holyoke, Mass., has prepared bulletin No. 28 about its electric industrial truck with an elevating platform.

CANOPY RING.—A circular giving detailed information about the new "Non-Twist" canopy ring for use in the connection of fixtures has been got out by the Non-Twist Canopy Ring Company, Toronto, Canada.

AUTOMOBILE BULBS.—An automobile lamp-bulb guide has been issued by the A. C. Mannweiler Company, Fort Wayne, Ind., and gives the proper lamp made by it for different types and models of gasoline passenger cars.

CLAMSHELL BUCKETS. — The Lakewood Engineering Company, Cleveland, Ohio, has issued bulletin No. 26. Its twenty-one pages are devoted to a general description and illustrations of this company's clamshell buckets.

AIR COMPRESSOR.—Four models of the electrically driven air compressors manufactured by the General Utility Company, 1326 Ogden Street, Philadelphia, are the subject of a folder entitled "The Low Cost of Cool Air" issued by this company.

VEGETABLE PEELERS.—The Maxim Manufacturing Company, 700 West Twenty-second Street, Chicago, has issued an illustrated circular on its "Sim-Peel-O" electrically driven peeling machines, knife polishers, butter cutter and potato masher and creamer.

AIR COMPRESSOR.—The "Usaco" two-stage portable air-cleaning motors, generators and similar machinery, an outfit which can be used for cleaning and has other applications, is described in a folder issued by the United States Air Compressor Company of Cleveland.

FLEXIBLE VARNISHED TUBING.—A card containing two samples of the new flexible varnished tubing made by the Irvington Varnish & Insulator Company, Irvington, N. J., and bearing a table of the different sizes of wire this tubing covers, is being distributed.

SAWING, FILING AND LAPPING MACHINES.—Four styles of sawing, lapping and filing machines are illustrated, described and priced in a recently issued leaflet from the Oliver Instrument Company of Adrian, Mich., which makes these machines.

PORTABLE ELECTRIC DRILLS.—The Black & Decker Manufacturing Company, Baltimore, Md., has recently prepared a folder relating the advantages of its portable electric drills.

CENTRIFUGAL TURBO BOILER FEED PUMP.—A new booklet setting forth the features and advantages of type CCC Coppus centrifugal turbo boiler-feed pumps has just been issued by the Coppus Engineering & Equipment Company, Worcester, Mass., which will supply copies upon application.

SCALE FOR FLEXIBLE COUPLINGS. —The "Selectometer," a device consisting of two separate cardboard circles mounted on a common center and forming a rotating scale for determining the correct size of "Francke" flexible coupling for different drives, has just been got out by the Smith-Serrell Company, 90 West Street, New York City. This concern, which is the general sales agent for the Francke Company, will send a "Selectometer" to those making requests.

WIRING DEVICES.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has just prepared a new sixty-four-page catalog entitled "C-H Wiring Devices; Push-Button Specialties," which is intended for distribution to jobbers, dealers, contractors, central stations and others interested. Push sockets, switches, conduit fittings, plugs and receptacles form the general subjects listed and described, space being devoted to the many different types made by this concern.

BOILERS.—The Heine Safety Boiler Company of St. Louis, Mo., has just completed printing the latest edition of its booklet, "Boiler Logic," which is an eighty-six-page well-illustrated treatise on steam boilers. Some of the main divisions of this book are "Some Fundamental Considerations of Boiler Design," "Practical Baffling of Water-Tube Boilers," "Heine Boilers for Different Fuels," "Firing and Services," "Overloads," "The Boiler as a Pressure Vessel," and "Details of Construction in Heine Boilers." This publication should prove of interest to all those concerned with steam-boiler engineering.

New Incorporations

THE FOREST ELECTRIC COMPANY of Arlington, N. J., has been incorporated with a capital stock of $15,000 by James K. Elderin, John W. Oliver of Newark and Daniel T. Dobyns of East Orange.

THE MURRAY WIRE COMPANY of Newark, N. J., has been incorporated by J. H. Murray, P. Igoenan and J. R. Cooney. The company is capitalized at $125,000 and proposes to manufacture wire products.

THE YANKEE BATTERY COMPANY of San Diego, Cal., has been incorporated by C. D. James, C. C. Benjamin and W. E. Zelley. The company is capitalized at $75,000 and proposes to manufacture electric batteries.

THE ROCKFORD FAN COMPANY of Utica, N. Y., has been chartered by M. Rockford, W. F. Bond of Utica and W. H. Clove of Rome. The company is capitalized at $100,000 and proposes to manufacture electric fans, etc.

THE DIXIE BATTERY & MANUFACTURING COMPANY of Pine Bluff, Ark., has been incorporated with a capital stock of $12,000 by Leo C. Graham, H. A. Irish and Arthur Graham. The company proposes to manufacture batteries.

THE UNION MACHINE COMPANY of Louisville, Ky., has been incorporated by Harry and Ray Buckley and M. L. Kannapell. The company is capitalized at $15,000 and proposes to manufacture mifling machinery and electrical devices and conduct a brass foundry.

THE TIDEWATER ELECTRIC COMPANY of New York, N. Y., has been incorporated by P. E. Matteson, C. Bohling and W. H. Shotwell, 91 Monroe Street, Brooklyn, N. Y. The company is capitalized at $6,000 and proposes to manufacture electrical specialties, etc.

THE SAFETY IMPULSE STARTER COMPANY of Harrisburg, Pa., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $2,500,000 to manufacture starting and lighting equipment for automobiles and trucks. The incorporators are E. M. Jauss and M. C. Miller.

New England States

YARMOUTH, ME.—The town of Yarmouth has petitioned the State Legislature for an amendment of its charter authorizing the town to supply gas and electricity.

BOSTON, MASS.—Bids will be received by B. Leighton Beal, secretary of Transit Department, city of Boston, until Feb. 25 for furnishing and installing roof lights in the Massachusetts Avenue surface station of the Boylston Street subway. Specifications and forms of contract may be obtained at 15 Beacon Street, ninth floor.

CLINTON, MASS.—The office building and power plant of the Metropolitan Water and Sewerage Board below the Wachusett Dam were destroyed on Feb. 17 by an overflow of water due to the breaking of the iron work in one of the large hydroelectric turbines within the plant's section of the works.

HOLDEN, MASS.—The installation of a fire-alarm system in Holden is under consideration.

LEOMINSTER, MASS.—The City Council is considering the question of establishing a municipal electric light plant.

MARLBORO, MASS.—The Marlboro Electric Company has authorized the erection of a new electric transmission line between the Marlboro station and the generating station at the Metropolitan reservoir at Fayville and also many practicable changes in the street lamps on Main Street as may be determined upon by the Mayor and the Council Committee.

NEW BEDFORD, MASS.—Bids will be received in the spring by the city of New Bedford for construction of hospital group on Mount Pleasant, Myrtle, Van Buren and Jefferson Streets, to include ward and operating buildings, laundry and power house, to cost about $100,000. J. S. Mcintyre, 22 Clifford Building, is architect. H. T. Borden, 154 Fair Street, is chairman of committee.

SOUTH BOSTON, MASS.—Bids will be received by the Commission on Waterways and Public Lands, Room 473, State House, Boston, until Feb. 26, for furnishing and installing ready for operation electric distribution systems for electric power and electric lighting, including large lead-sheathed copper cables and junction boxes for power, and small transformers, conduit, wiring, fixtures, etc., for interior lighting in pump house, at the dry dock which the Commonwealth is constructing at South Boston. Frank W. Hodgdon is engineer.

PROVIDENCE, R. I.—The United States Shipping Board is planning to erect a building, 60 ft. by 304 ft., for machine shop and office at the new marine railroad at Fields Point.

Middle Atlantic States

BROOKLYN, N. Y.—The Board of Trade, Bedford Section, is said to be considering plans for improvements in the electric street-lighting system on Nostrand Avenue and Fulton Street in this district.

BUFFALO, N. Y.—Plans are under consideration by Arthur W. Kreinheder, commissioner of public works, for various municipal work during the present year, including the completion of the large power station on Porter Avenue.

CREEDMOOR, L. I., N. Y.—Arrangements are being made by the State Hospital Commission, Capitol, Albany, for the erection of a group of hospital buildings at Creedmoor, to be used in conjunction with the Brooklyn Hospital for the Insane. Large quantities of electrical equipment, it is understood, will be required.

KINGSTON, N. Y.—Arrangements are being made by the Hudson Power Corporation for the construction of a new electric power plant to be located on the Wallkill River, near New Rifton. This company, it is understood, is affiliated with the Kingston Gas & Electric Company. The J. G. White Engineering Corporation, 43 Exchange Place, New York, is engineer.

MOHAWK, N. Y.—Plans are being prepared for the construction of a new hydraulic power plant to be used in connection with the operation of the Barge Canal. W. W. Wotherspoon is superintendent of public works; Frank W. Williams, Telephone Building, Albany, is state engineer.

NEW YORK, N. Y.—Contract has been placed by the United Electric Light & Power Company with the Westinghouse Electric & Manufacturing Company for an additional 22,000-kw. turbo-generator, with the necessary condenser and auxiliary apparatus, to be delivered late in 1919, for installation in the 201st Street station of the company. With this additional unit the station will have a generating capacity of 129,000 kw.

NIAGARA FALLS, N. Y.—Contract has been awarded by the Union Carbide Company, Union Street, to the J. F. McKinney Company, Union Street, for the construction of an electric station, about 53 ft. by 139 ft., to cost about $45,000.

SALAMANCA, N. Y.—Arrangements are being made to begin work on the installation of a new 350-hp. engine in the municipal electric power plant.

SANGERFIELD, N. Y.—The Public Service Commission has granted the Waterville (N. Y.) Gas & Electric Company permission to erect an electric transmission line from Waterville to Sangerfield.

WARD'S ISLAND, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until March 4 for dining-room accommodations for patients in main building, including construction work, heating, sanitary and electric work at the Manhattan State Hospital, Ward's Island, N. Y. E. S. Elwood is secretary of State Hospital Commission.

EAST ORANGE, N. J.—Plans are under consideration by the City Council for the installation of a new electric street lighting system on Central Avenue and Main Street. The service will be supplied by the Public Service Electric Company.

NEWARK, N. J.—Plans are under consideration by the Hillside Township Committee for the installation of a new street-lighting system on Fairbank, James, Bond, Clark and Virginia Streets and Coe, Roanoke and Ridgway Avenues.

NEWARK, N. J.—Electrically operated equipment, it is understood, will be installed in connection with the proposed development of watersheds at Wanaque and Pequannock, for which bond issues for $500,000 and $300,000 respectively have been disposed of by the city.

NEW BRUNSWICK, N. J.—Considerable electrical equipment will be required in connection with new construction of the proposed new Albany Street drawbridge, to cost about $128,575, now under consideration by the Board of Freeholders.

TRENTON, N. J.—Plans, it is understood, are being considered by the Council for the installation of new pumping equipment at the Riverside Heights and Fair Street sewage-pumping station.

VERONA, N. J.—The Board of Chosen Freeholders has engaged Runyon & Carey, 845 Broad Street, Newark, as consulting engineers, for electrical, heating and ventilating work in connection with the construction of the proposed group of five one-story hospital buildings at the local Hospital for Tubercular Diseases. The cost is estimated at about $120,000.

HARRISBURG, PA.—The Public Service Commission has granted the Harrisburg Light & Power Company permission to issue $215,000 in notes and $35,000 in bonds.

MEADVILLE, PA.—Contract has been awarded by the Meadville Malleable Iron Company for the construction of a new power plant at its works to the Harper Building & Lumber Company, to cost about $10,000.

PHILADELPHIA, PA.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for additions to shops Nos. 2 and 3 at the League Island Navy Yard, Philadelphia, to cost about $325,000.

PHILADELPHIA, PA.—Plans have been prepared by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the erection of a substation at Piers A and B at the League Island Navy Yard (Specification 3796).

TORRANCE, PA.—The board of trustees of the Western State Hospital for the Insane is considering plans for the construction of a new group of hospital buildings, to cost approximately $2,000,000. A large power plant and mechanical laundry building are included in the plans. Samuel S. Richard of Altoona is chairman of board.

UPPER DARBY, PA.—Contract has been awarded by the Philadelphia & Western Railway Company for the construction of two electric substations at its properties at Villa Nova and Beechwood. H. P. Friend, Boyer Arcade, Norristown, has the contract for the erection of the buildings.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

BALTIMORE, MD.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 3, for furnishing the labor required in the construction, complete, including heating, plumbing, electric conduits and wiring, with materials that will be furnished by the government, of hospital unit A-special, hospital unit B-1, the attendants' quarters, additions and changes in the kitchen and mess hall, at the United States Marine Hospital at Baltimore, Md. Bids will also be received at the same time and place for furnishing electrical and lighting materials for the hospital unit A-special, hospital unit B-1, the attendants' quarters, additions and changes in the kitchen and mess hall, and for outside services at the United States Marine Hospital at Baltimore. Drawings and specifications may be obtained from the custodian or from the above office.

CUMBERLAND, MD.—Revised plans are being prepared for the proposed rubber-tire factory to be erected in Cumberland by the Kelly-Springfield Tire Company of Akron. Bids for construction will probably be received in April or May. The original plans provided for an expenditure of $5,000,000 for land, buildings, equipment, power plant, electric lighting system, etc. Construction work was delayed on account of the war. Harry B. Blanchard of Akron, Ohio, is the company's engineer; D. S. Diescher & Sons, Farmers' Bank Building, Pittsburgh, Pa., are consulting engineers.

BECKLEY, W. VA.—Contract, it is reported, has been awarded by the Virginian Railway Company for the construction of a power plant which, when completed, will furnish electricity along its system from Elmore to Clarks Gap, a distance of 14 miles. H. Fernstrom of Norfolk, Va., is chief engineer.

WILLIAMSBURG, VA.—The Williamsburg Power Company, it is reported, would like to receive prices on generators and boilers.

WASHINGTON, D. C.—The Potomac Electric Power Company has recently completed the extension to the turbine and boiler rooms at its Bennings plant, consisting of the installation of one 15,000-kw. Westinghouse turbo-generator and Worthington surface condenser, and also six 1000-hp. Babcock & Wilcox boilers, with Taylor stokers, together with coal and ash-handling equipment, boiler-feed pumps, heaters, etc. Plans have been completed and contracts are now being awarded for the second extension of the turbine room, consisting of the installation of one 20,000-kw. General Electric turbo-generator and Worthington condenser. Work on this extension will begin on March 1. Plans have been prepared by and all work will be carried out under the supervision of Francis R. Weller, consulting engineer, Hibbs Building, Washington, D. C.

North Central States

OXFORD, OHIO.—The Village Council has decided to abandon the municipal electric light plant and to purchase energy from the Liberty Light & Power Company of Richmond, Ind., to operate the local system. It is also proposed to equip the waterworks station for electrical operation later on.

ROCKY RIVER, OHIO.—The sale of the plant of the Rocky River Light & Power Company to the village of Rocky River at $63,000 has been authorized by the State Public Utilities Commission.

ALBION, IND.—Improvements are contemplated to the municipal electric lighting system, including the installation of one constant-current transformer for series street lamps and 50 suspension type street lamps for series system. Contracts will probably be let about May 1, 1919. E. M. Maloney is superintendent.

LOGANSPORT, IND.—The City Council has approved a resolution to appropriate $5000 for the purchase of poles and wire for the purpose of erecting a transmission line from the electric plant to the new Pennsylvania shops.

SHELBYVILLE, IND.—Plans have been completed by the Board of Commissioners of Shelby County for the installation of a new power plant at the Shelby County Hospital.

BENTON, ILL.—The Hamilton Utilities Company, operated by the Central Illinois Public Service Company of Mattoon, is erecting a new substation, outdoor type, equipped with three 100-kva. transformers. Aluminum-cell arresters will be used. A. W. Mann, electrical engineer, of Mattoon, has charge of the work.

DECATUR, ILL.—The installation of a power and heating plant, to cost about $35,000, is reported to be under consideration by the Comet Automobile Company.

NEW ULM, MINN.—Extensions to the municipal electric light and water plants are under consideration by the City Council. A. J. Mueller is superintendent.

TYLER, MINN.—At an election held recently the proposal to issue $20,000 in bonds to rebuild the electric and water plants was carried.

WILLMAR, MINN.—The City Council is considering the purchase of an engine and electric generator for the municipal electric light plant.

ATLANTIC, IOWA.—Plans are under consideration for improvements to the municipal electric light plant, including the installation of one 625-kva. turbine, one 500-kw., two-phase, 60-cycle, 2200-volt generator, switchboard and two ammeters. Contracts for the above equipment will probably be let about March 1. T. E. Nichols is superintendent.

BATTLE CREEK, IOWA.—Extensive improvements are under way at the plant of the Charles E. Churchill Electric Light, Heat & Power Company, including the installation of one 100-hp. horizontal return tubular boiler, one Murray Corliss engine and one Chandler-Taylor engine, one 75-kva. Fairbanks-Morse and one 50-kva., Westinghouse generator, automatic regulator and two sets of instruments for three phase, 2300-volt, 60-cycle service; two 10-kva., six 5-kva. and twelve 2-kva. transformers, and overhead material for about 10 miles of line; 250 5-amp. and 10-amp. meters. Incandescent lamps to cost about $1,200 will be purchased this year. Charles E. Churchill has charge of the work.

KANSAS CITY, MO.—Extensive improvements are contemplated by the Kansas City Light & Power Company, involving an expenditure of about $5,500,000. H. C. Blackwell is vice-president and manager.

MARSHFIELD, MO.—Contract, it is reported, has been awarded by the Missouri Valley Water Company of Lebanon for the construction of a hydroelectric power plant on the Niangua River, about 12 miles from Marshfield. From this plant the company proposes to furnish electricity in the towns of Marshfield, Conway, Phillipsburg, Lebanon, Stoutland, Richland and Dixon, which have voted the company franchises to furnish power. It is estimated that about 2900 hp. can be developed at this point. The cost of the dam, plant and transmission lines to Lebanon and Marshfield is estimated at $235,000. The company expects ultimately to build five dams on the Niangua River. J. D. Whitmore of Valley, Neb., is at the head of the company.

MARSHALL, MO.—Plans are being prepared for the installation of an electric light plant in connection with the present waterworks system, for which bonds to the amount of $75,000 were recently sold. The equipment will probably consist of one 150-kw. and one 250-kw. generator, steam driven; one boiler, switchboard and pole-line materials. Henrici-Lowry, Commerce Building, Kansas City, Mo., are engineers.

ARLINGTON, NEB.—An election will soon be called to submit to the voters the proposal to issue $15,000 in bonds for the erection of an electric transmission line.

PLYMOUTH, NEB.—The Nebraska Gas & Electric Company of Beatrice is reported to be considering the installation of an electric plant in Plymouth. B. U. Conlee is manager.

DOWNS, KAN.—The United Light & Power Company, recently organized, has purchased the property of the Solomon Valley Power Company, consisting of electric generating plant, transmission and distribution lines. One boiler will be repaired and a new boiler installed at once. Later a second unit will be installed. A. G. Blankenship is secretary.

OTTAWA, KAN.—Plans are being prepared for the installation of a 500-kw. electric generating unit with condensing equipment in the municipal electric light plant. Bids on steam engines and turbines will be considered. W. C. Myers is superintendent of the water and light department.

RANDOLPH, KAN.—The property of the Randolph Light Company, consisting of an engine, generator, batteries moving picture machine, etc., it is reported, will be sold at auction on Feb. 22.

TOPEKA, KAN.—An appropriation of $10,000 has been voted by the State Legislature for improvements to the water system and steam heating and electric light plants at the State Hospital in Topeka.

Southern States

SPARTANBURG, S. C.—The Manufacturers Power Company has been granted a franchise to supply electricity in Spartanburg. The company has completed an electric transmission system from its hydroelectric plant on Green River, near Hendersonville, N. C., to the city limits of Spartanburg. Walter S. Montgomery is president of the company.

ALBANY, GA.—The property of the Albany Power & Manufacturing Company, it is reported, has been purchased by the Foy & Shemwell & Foy Company, who will operate the system in Albany under the name of the Georgia-Albany Power Company. The new owners propose to connect all their plants, making an available supply of 50,000 hp. from the three plants, with their steam auxiliary plants.

ASHBURN, GA.—The transmission lines of the municipal electric light plant may possibly be extended into the country, a distance of 2½ miles, to furnish electricity for lamps and motors to farmers along the line. Nothing definite as yet has been decided upon. S. K. Smith is superintendent.

ATLANTA, GA.—At an election to be held March 5 the proposal to issue $300,000 in bonds to construct an electric generating plant at the city garbage crematory will be submitted to the voters.

BAINBRIDGE, GA.—Improvements are contemplated to the municipal electric light plant, including the installation of one 250-hp. boiler, engine, generator and switchboard. The proposed work depends upon authorization of a bond issue. E. N. Edwards is superintendent.

JACKSONVILLE, FLA.—The C. I. Capps Company of Jacksonville, recently organized, would like to receive prices on electric furnaces. C. I. Capps is president and manager.

MARIETTA, OKLA.—The City Council is considering calling an election to vote on the proposal to issue bonds for improvements to the municipal electric light plant and waterworks system.

TULSA, OKLA.—The Pioneer Coal & Mining Company of Tulsa, recently incorporated, is reported to be in the market for coal mining equipment, power-plant machinery, etc. The company is capitalized at $200,000. R. B. Pugh and C. A. Coffey of Morris, Okla., are interested in the company.

WALTERS, OKLA.—An election will soon be held to vote on the proposal to issue $45,000 in bonds for extensions to water, light and sewer systems. A. H. Japp is city attorney.

WOODWARD, OKLA.—An election will soon be held to vote on the proposal to issue $30,000 in bonds for improvements to the municipal electric plant and waterworks system.

MATAGORDA, TEX.—Contract has been awarded by the Texas Gulf Sulphur Company to the J. G. White Company of Dallas for the construction of a model town at its sulphur mines near Matagorda. An electric light and power system will be installed. The proposed town will be known as Welfare Settlement and will accommodate 1500 families.

SAN ANGELO, TEX.—In a report submitted to the Municipal Commission by the Citizens' Committee the purchase of the electric light and water plants of the San Angelo Water, Light & Power Company is recommended. The value of the these plants is estimated at $350,000. If the utilities are taken over by the city extensive improvements, it is stated, will be made.

SAN BENITO, TEX.—The San Benito Water & Electric Company is considering improvements to its system.

WICHITA FALLS, TEX.—The Texas Gulf Refining & Pipe Line Company has purchased a site of 135 acres, 4 miles south of Wichita Falls, on which it will build a model town, to be called Oildom. A large oil refinery will be erected on the land and public utility plants will be installed.

Pacific and Mountain States

SPOKANE, WASH.—The property of the Spokane Heat, Light & Power Company has been purchased by the Washington Water Power Company of Spokane. The steam distributing system of the Spokane company, it is understood, will be operated by the Washington Water Power Company.

YAKIMA, WASH.—The pole lines of the Pacific Power & Light Company in the Yakima Reservation were damaged to the extent of $12,000 by the high wind during recent storms.

ASTORIA, ORE.—The Pacific Power & Light Company, it is reported, is considering the installation of an additional generating unit at its local plant.

ASTORIA, ORE.—Additional bonds totalizing $750,000 have been authorized by the Port of Astoria, the proceeds to be used in proposed extensions during the coming year, which will include an export and import pier and warehouse, an additional power plant for the city, etc.

PORTLAND, ORE.—The West Coast Coal & Dock Company of Portland is contemplating the construction of large coal bunkers for handling ship fuel and exporting coal.

LOS ANGELES, CAL.—Plans have been prepared by the City Commission for the erection of an electric transmission line to supply electricity to the municipal pumping plant in the Ellendale district, to cost about $4100.

SACRAMENTO, CAL.—An election has been called to vote on the proposal to issue bonds for the construction of a new filtration plant, to cost with machinery and equipment $1,200,000; wharf and warehouse, $160,000, and incinerator plant $143,000. If the project is carried through considerable electrical and mechanical equipment, including motors, hoisting and conveying apparatus and general transmission machinery, will be required. The proposed work will be in charge of the city engineering department.

COOKE, MONT.—The Western Smelter & Power Company is contemplating the installation of a 100-hp. motor to operate an air compressor at its mine and also to install additional transformers at its hydroelectric plant to step up the voltage to 23,000 for transmission to other mines in this district.

Canada

VANCOUVER, B. C.—Plans are being prepared by the Canadian Pacific Railway Company for the construction of a coaling plant at North Bend. The company also contemplates building a power house at Smithers, B. C., to cost including machinery about $25,000. F. W. Peters of Vancouver is superintendent.

WINNIPEG BEACH, MAN.—Extensive improvements are contemplated by the Canadian Pacific Railway Company to its local property, including the erection of a power house, rebuilding a number of the present dwellings, etc.

FREDERICTON, N. B.—The Minto Coal Company is contemplating the installation of new machinery at its mines. Large steam and electrically operated shovels are under consideration. John Henderson is manager.

PEMBROKE, ONT.—Bids will be received by A. J. Fortier, Pembroke, until March 7 for furnishing and installing a pumping unit at the waterworks station, consisting of a turbine pump of 2000 gal. capacity against a 350-ft. head and steam turbine or gasoline engine directly connected to pump.

WINGHAM, ONT.—The Town Council is considering improvements to the municipal electric lighting system.

REGINA, SASK.—The International Harvester Company is planning to dispose of its present quarters in Regina and erect a new plant at Sixth Avenue and Broad Street, to cost about $1,000,000.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Feb. 24 for cable, bolts, nuts, conduit, condulets, indicator, rheostats, sockets, grommets, pipe covering, etc. Blanks and further information relating to this circular (1256) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, Cal.

PANAMA.—Bids will be received at the office of the general purchasing agent, the Panama Canal, Washington, D. C., until March 8 for steel, iron, pipe, lead, wire, copper, bronze, brass tubing and tubes, motors, marine electrical fixtures, junction boxes, electrical receptacles, duct tile, etc. Blanks and further information relating to this circular (1257) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York City; 606 Common Street, New Orleans, La., and Fort Mason, San Francisco, California.

Record of Electrical Patents

Notes on United States Patents

(Issued Dec. 31, 1918)

1,289,354. STORAGE-BATTERY GRID; Edward F. Andreae, Newark, N. J. App. filed June 29, 1916. Of the double-latticed type and does not require use of destructible cores, drawbars, etc., but may be made in a two-part mold.

1,289,362. SYSTEM OF ELECTRICAL DISTRIBUTION; Ernst Bauer, Niagara Falls, N. Y. App. filed July 17, 1916. Relates to car-lighting systems in which the generator, driven by the car axle, supplies a variable voltage for charging a storage battery and supplying a translation circuit.

1,289,365. ELECTRIC BATTERY; Raymond C. Benner and Harry F. French, Fremont, Ohio. App. filed July 13, 1916. Negative element consists of a perforated receptacle containing copper oxide bound together by sulphur and an alkaline electrolyte.

1,289,366. ELECTRIC BATTERY; Raymond C. Benner and Harry F. French, Fremont, Ohio. App. filed July 31, 1916. An alkaline electrolyte combined with a zinc electrode and a negative element containing a mixture of copper oxide and selenium.

1,289,369. METHOD OF INCREASING THE CAPACITY OF PHOTOSENSITIVE ELECTRICAL CELLS; Sven A. Berglund, Stockholm, Sweden. App. filed April 24, 1916. Consists in absorbing, while the cell is exposed to light, the heat generated in the cell as fast as it is generated.

1,289,371. SIGN; Le Roy Blades, Chicago, Ill. App. filed Sept. 10, 1915. Especially adapted for indicating the time of day.

1,289,374. TERMINAL BLOCK FOR ELECTRICAL MEASURING INSTRUMENTS; William M. Bradshaw and Walter G. Mylius, Wilkinsburg, Pa. App. filed Feb. 3, 1916. Will not be subject to fracture because of the unequal expansion of the insulating member and the contact terminals.

1,289,406. TRANSFORMER; Walter M. Dann, Wilkinsburg, Pa. App. filed Oct. 2, 1914. Weighs considerably less than a transformer of equal capacity and of the common type of construction.

1,289,418. HIGH-FREQUENCY DETECTOR; Gustaf W. Elmen, Bogota, N. J. App. filed Nov. 23, 1915. For detecting the presence of oscillatory currents in a conductor.

1,289,419. IGNITION DISTRIBUTER; Lawrence Ericson, Chicago, Ill. App. filed Jan. 17, 1916. Operates to automatically advance and retard the spark furnished to an internal-combustion engine by the distributer in response to changes of speed in the engine.

1,289,668. SYSTEM OF ELECTRIC SIGNALING; Louis Cohen, Washington, D. C. App. filed June 30, 1916. Dispenses with the artificial line or cable in duplex systems of telegraph and also lends itself to embodiment in systems designed for multiplex telegraphy.

1,289,672. METHOD OF PRODUCING AND MAINTAINING VACUUMS; William D. Coolidge, Schenectady, N. Y. App. filed Feb. 5, 1916. A desired high vacuum is maintained in an electric apparatus operating with an electron discharge to prevent harmful positive ionization of gas.

1,289,686. ELECTRIC PIPE-THAWING APPARATUS; Emmet C. Davey, Mankato, Minn. App. filed July 26, 1918. Can be operated by current of ordinary voltage and permits bare copper wire to be used to connect to the pipes and to be laid across streets without danger of animals or pedestrians passing over the same.

1,289,704. TELEPHONE SYSTEM; Alfred H. Dyson, Montclair, N. J. App. filed March 14, 1917. The caller's coin is returned in case a connection is not obtained and is deposited in a receptacle at the substation in case a connection is obtained.

1,289,787. COMPUTING MACHINE; Shohei Iyesaka, Seattle, Wash. App. filed May 25, 1915. The features are magnetically operated finger keys, electrical carrying and electrically operated clearing mechanism.

1,289,788. MOTOR STARTER; Benjamin B. Jackson, Chicago, Ill. App. filed May 9, 1916. For a non-self-starting prime mover such as an internal-combustion engine or a single-phase alternating-current motor of the induction type.

1,289,823. ELECTRIC-DISCHARGE-CONTROLLING DEVICE AND METHOD OF OPERATING THE SAME; Irving Langmuir, Schenectady, N. Y. App. filed Nov. 6, 1914. Comprises an electrical discharge apparatus and systems of connections suitable for utilization in electric signaling, such as aërial telephony.

1,289,826. HEAD RECEIVER SET; Burton L. Lawton, Meriden, Conn. App. filed June 28, 1918. The two earpieces may be worn with comfort and at the same time will be positioned for the best results.

1,289,853. AUTOMATIC TELEPHONE SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Feb. 26, 1914. Improved means for enabling one subscriber on a party line to signal a second subscriber on the same line.

1,289,854. AUTOMATIC TELEPHONE SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Feb. 21, 1916. Invention relates particularly to systems comprising a main exchange and one or more sub-exchanges.

1,289,863. ELECTROMAGNETIC STEP-BY-STEP MECHANISM; Jay G. Mitchell, Chicago, Ill. App. filed May 4, 1918. Of the type employing an electromagnet and a ratchet-actuating pawl moved by the magnet.

1,289,864. ELECTRICAL MASSAGE APPARATUS; Alfred Modern, Chicago, Ill. App. filed May 31, 1917. Electrotherapeutic device enables the person undergoing treatment to self-administer the same.

1,289,896. TUNGSTEN-REDUCING FURNACE; Carl A. Pfanstiehl, Waukegan, Ill. App. filed April 26, 1915. Very fine tungsten powder of a non-crystalline character may be produced.

1,289,898. MEANS FOR TRANSMITTING AND RECEIVING ANGULAR OR ROTARY MOTIONS; Robert W. L. Phillips, County of Bedford, England. App. filed June 4, 1917. Apparatus comprises two ring stators with secondary closed, ring winding interconnected at three or more points of uneven number and surrounding diametral "bar" rotors, one to each, one or both of which rotors carry primary coils.

1,289,899. TELEGRAPH TRANSMITTER; Edwin H. Piersen, Topeka, Kan. App. filed May 28, 1918. The character members may be accumulated and released in proper sequence irrespective of the speed at which the keyboard is operated.

1,289,900. TELEGRAPH TRANSMITTER; Edwin H. Piersen, Topeka, Kan. App. filed May 19, 1913. Key levers punch apertures in a traveling web which, when carried past the circuit closer, actuate the closer and in turn make and break a circuit to transmit electrical impulses corresponding to the Morse or other telegraphic codes.

1,289,901. TELEGRAPH TRANSMITTER; Edwin H. Piersen, Topeka, Kan. App. filed May 31, 1913. Characters are set by means of a keyboard and transformed into electrical impulses through the medium of a circuit closer.

1,289,913. ELECTRIC LIGHT SUPPORT; Paul J. Riviere, Jersey City, N. J. App. filed July 19, 1918. A plurality of electric lamps are mounted and may be adjusted to a variety of positions.

1,289,932. WELDING SYSTEM; John A. Seede, Schenectady, N. Y. App. filed Sept. 12, 1917. Arc may be supplied with current from a device having an inherent regulating characteristic suitable for welding while avoiding the deleterious effect of an initial rush of current prior to the establishment of welding conditions.

1,289,935. DIFFERENTIAL MAGNETIC SPEED-CHANGING TRANSMISSION MECHANISM; Charles H. Seidel, Havana, Cuba. App. filed Oct. 30, 1916. A rotating field and armature electrical machine forms a clutch between the engine and driving wheels of a vehicle.

1,289,941. APPARATUS FOR LOADED TELEPHONE-LINE SYSTEM; Thomas Shaw and William Fondiller, Hackensack, N. J. App. filed Sept. 12, 1914. Invention relates more particularly to loaded phantom-line systems.

1,289,969. CONTROLLING APPARATUS FOR AUTOMOBILE RADIATOR SHUTTERS; Edgar Tregoning, Attleboro, Mass. App. filed March 9, 1918. Thermostatically controlled, electrically operated device is under the influence of changes in temperature in the engine of the motor.

1,289,981. WIRELESS SIGNALING APPARATUS; Roy A. Weagant, Roselle, N. J. App. filed April 2, 1915. Adapted for use as a detector of electrical oscillations in association with a local circuit and an indicating device such as a telephone receiver, and in addition the oscillating circuit is electrically connected with the valve and the telephone circuit.

1,289,996. ELECTRIC SWITCH; Gilbert Wright, Schenectady, N. Y. App. filed May 5, 1915. Aims to minimize the danger of operating and working with switches and with the apparatus they control.

1,290,012. TROLLEY-COLLECTOR DEVICE; De Witt W. Bisbee, Los Angeles, and Peter A. Cressey, Long Beach, Cal. App. filed Jan. 2, 1917. A rotatable disk engages the wire instead of a roller or sliding bow.

1,290,013. ELECTRICAL REGULATION SYSTEM; William F. Bouche, Buffalo, N. Y. App. filed June 18, 1915. Additional resistance is automatically inserted in series with the carbon-pile regulator when the load is too large for the latter.

1,290,036. THERAPEUTIC APPARATUS; Fritz A. Anderson, Milton, Wis. App. filed March 4, 1918. A rigid but light and foldable supporting structure is provided for the casings of heating and lighting devices intended for therapeutical use.

(Issued Jan. 7, 1919)

1,290,053. SCREW-CONTACT DEVICE; Reuben B. Benjamin, Chicago, Ill. App. filed Sept. 10, 1915. Can be formed by stamping.

1,290,066. ELECTRIC TRAIN-LINE COUPLING; Thomas R. Brown, Sparkill, N. Y. App. filed Dec. 8, 1916. Engaging surfaces kept clean and high degree of conductivity maintained through coupling joint at all times.

1,290,075. RHEOSTAT; Charles A. Cadwell, Cleveland, Ohio. App. filed May 10, 1917. Is portable, so that it can be kept within reasonable compass and be carried by two men.

1,290,076. METHOD OF AND APPARATUS FOR ELECTRIC WELDING; Charles A. Cadwell, Cleveland, Ohio. App. filed June 2, 1917. A current of relatively high voltage may be utilized in welding one metal part to another.

1,290,079. ELECTRICALLY OPERATING TRANSLATOR; Allen D. Cardwell, Brooklyn, N. Y. App. filed Dec. 1, 1915. Particularly adapted for use at transmitting or receiving stations, or both, in telegraph typewriter systems.

1,290,082. PUSH-BUTTON SWITCH; Ivar Carlson, Leominster, and Rudolf A. Johnson, Worcester, Mass. App. filed Dec. 29, 1917. Characterized by compactness, inexpensiveness, simplicity of construction and facility of operation.

1,290,089. APPARATUS FOR ELECTRIC WELDING; William B. Cleveland, Cleveland, Ohio. App. filed April 23, 1915. Adapted for welding or brazing of bonds onto rails in accordance with so-called "Herrick" process.

1,290,114. THERMIC TELEPHONE; Pieter de Lange and Baron Van Lynden, Utrecht, Netherlands. App. filed Nov. 4, 1915. Sounding chamber so constructed that the parts inclosing it may be displaced relatively to each other.

1,290,147. DEAD END FOR ELECTRIC AND TELEPHONE WIRES; Harry Fairclough, Los Angeles, Cal. App. filed Jan. 26, 1916. Minimizes breakage from heavy strain and from crystallization.

1,290,148. AUTOMATIC TELEPHONE RELEASE; Edward D. Fales, Western Springs, Ill. App. filed Feb. 27, 1908. For automatic systems in which electrically propelled and step-by-step-actuated switches are employed for extending connection from one point to another.

1,290,153. WIRE TAPPER; Joseph Fitzpatrick, Douglas, Ariz. App. filed March 30, 1918. Employs a two-part casing of insulating material, the sections being connected by hinges.

1,290,167. CURRENT-RECEIVING APPARATUS; John E. Gallant, Boston, Mass. App. filed May 29, 1917. Sparking in the rectifying apparatus when the current is broken or reversed is materially reduced or entirely prevented.

1,290,190. GENERATING MECHANISM; Albert B. Herrick, Cleveland, Ohio. App. filed Nov. 29, 1912. Particularly for use in an igniter attached to an engine cylinder in the position usually taken by the spark plug.